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CREWSTATION ASSESSMENT OF REACH AS APPLIED TO THE OH-58A HELICOPTER

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VITA

Michael Gregory Genetti, son of Albert Joseph and Marguerite (Trapolino) Genetti, was born on March 1, 1953, in Washington, D.C. He attended public and private schools in various states and graduated from DeMatha Catholic High School, Hyattsville, Maryland, in 1971. In July, 1971, he entered the United States Military Academy, West Point, New York, and received the Degree of Bachelor of Science (General Engineering) in June, 1975. For the next eight years he served in various assignments in both the continental United States and Europe. He received the degree of Master of Science from the American Technological University, Killeen, Texas, in December, 1982. He entered the Graduate School, Auburn University in June, 1983. He married Lori, daughter of Robert Wills Sandercock and Ann (Ross) Van Wert in November, 1979. They have a son, Michael Gregory, Junior, and a daughter, Ann Elizabeth.

THESIS ABSTRACT

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A computer evaluation program, Crewstation Assessment of Reach (CARII), was utilized to determine the effectiveness of an evaluation designed for a single person workstation on a two person workstation. The workstation chosen for evaluation was the U.S. Army Helicopter OH-58A. To compensate for the multiple person workstation, the cockpit was defined from three points of view as follows: the pilot while flying, the copilot while flying and an observer in the copilot's station. Through an internal mechanism in the CAR program, a sample of "link-men" was generated from the means and standard deviations of twelve anthropometric measurements from the data of the 1970 survey

of U.S. Army aviators. These link-men were then evaluated for their accommodation to the 24 controls defined in the workstation. Through the example of the relocation of one control, it was demonstrated that an evaluation tool such as CAR should be utilized in the design process.

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I. INTRODUCTION

Statement of the Problem

The problem of this study was to determine the effectiveness of the design of a two-person (shared) workstation by using a computerized evaluation method designed to evaluate the percent population accommodated by a single person workstation.

Hypotheses

The hypotheses of this study are as follows:

1. By treating each operator location separately, the evaluation will determine the percent of the population accommodated exactly as if it were a single person workstation.

2. By 'weighting' the importance of each of the operators stations, the optimal design of the shared workstation can be determined.

Background and Introduction of the Study

> Over the past 30 years, physical anthropologists have been concerned with the documentation and description of human body size variability and its application to design. A significant problem continues to exist, however, in the communication of such knowledge to the wide variety of potential users, the design community. (Panero and Zelnick,1979)

Thus begins the Foreword by Dr. John T. McConville to Panero

and Zelnick's Human Dimension and Interior Space. Dr. McConville goes on to mention that one member of the design group that needs this important knowledge is that of aircraft cockpit designers. Woodson and Conover (1964) state that applying human engineering in design is not an exact science. They warn against considering the designer as an average person or as the representative of the population that will use the device. Panero and Zelnick (1979) point out that designing for the average is poor in that there really is no 'average man'. They say that a man average in stature may not be average in weight, sitting eye height, etc. In fact, those men average in any four anthropometric measure categories are less than 2% of the population total.

Due to the researcher's military flying experience, the particular shared workstation examined will be that of the OH-58A observation helicopter cockpit. The need to include human engineering in the military cockpit design task was seen at least 30 years ago. This occurred when the North Atlantic Treaty Organization (NATO) Advisory Group for Aeronautical Research and Development held a symposium in the Netherlands entitled "Anthropometry, Human Engineering and Related Subjects." From this symposium came papers with such titles as "Body Measurement in Relation to Work Spaces in Aircraft" and "Adapting the Aeroplane to the Pilot" (AGARD, 1955). Even earlier than that, Fitts and Jones (1947) analyzed factors contributing to "pilot-error"

experiences, among them the inability to reach controls while operating the aircraft. The problems existing in aircraft cockpits have been recognized for years, but unfortunately some problems still exist. The need to examine military cockpits, in particular helicopter cockpits, for optimal design is readily apparent.

In addition to designing a cockpit based strictly on body dimensions, the factor of internal stress of the operator while performing in varied environments must be taken into consideration. Verdier (1960) breaks down internal stress into two factors: physiological or physical stress and psychological stress. When considering the possible wartime scenarios in which the Army aviator may be found, both physiological and psychological stress could be at very high levels. If the aviator is to perform the many assigned missions, the act of flying an aircraft must be nearly 'second nature'. A properly designed cockpit with displays and controls optimally located which permits the crew to function together as a team is essential.

Significance of the Study

The significance of this study is that it will demonstrate to both designers and users of helicopters that computer based evaluation procedures exist that, although not designed for the shared workstation, can and should be used in the design process to determine what percentage of the user population can fit into and perform the required

functions in the cockpit. Through the use in the design stage, users will not be forced to adapt to a poorly designed final product.

Definition of Terms

OH-58A: An OH-58A (Figure 1) is a four seat aircraft made by Bell Helicopter that is used mainly in scout and command and control modes.

Cyclic: The cyclic is a main flight control gripped by the pilot's right hand. It provides input to the main rotor disk allowing for hovering, forward, sideward or rearward flight. The cyclic control handle contains switches for the intercom, radio transmission, and force trim interrupt.

Collective: The collective is a main flight control gripped by the pilot's left hand. It provides input to the angle of attack of the main rotor blades, giving upward and downward movement to the aircraft. The handle of the collective is the throttle. Located on the collective are also the starter switch, and the landing light on/off switch.

Antitorque pedals: The antitorque pedals are foot controls that adjust the pitch angle of attack in the tail rotor system. In hovering flight the antitorque pedals provide directional control while in flight they help to 'trim' the aircraft.

Overhead console: The overhead console is a 'ceiling' panel located between the pilot and copilot containing

Figure 1. OH-58A Helicopter

the circuit breakers, battery switch and assorted other switches (heater, defog and vent, etc.).

Proximity Warning Device (PWD): The proximity warning device is a device located on the main instrument panel that will alert the pilot of other aircraft similarly equipped that are within up to 300 feet above or below and up to 3000 feet radius. The warning is in the form of an audio alert and flashing lights with the following possibilities: Intruder is above, above/equal, equal, equal/below, or below in altitude in relation to the aircraft position.

Very High Frequency (VHF) Radio: The VHF radio is a two way radio used for air-to-air and air-to-ground communications. The control head is located on the main instrument panel.

Frequency Modululation (FM) Radio: The FM radio is a two way radio mainly used for air-to-ground communication, especially to maintain contact with ground combat units. The control head is located on the instrument console between the pilot's and copilot's seats.

Interphone Control Panel: The interphone control panel is a panel to allow the pilot/copilot to monitor radio(s) desired and select to talk on the intercom system or one of the radios. There are two interphone control panels located on the main instrument control panel.

Ultra High Frequency (UHF) Radio: The UHF radio is a two way radio used mainly in an air-to-air communications role. It is usually located centrally on the main instrument control panel.

Transponder: The transponder is an active radar device that sends out codes to radar receivers so that the position of the aircraft can be monitored from the ground. Together with an appropriate altimeter, the aircraft's altitude as well as position can be monitored. The transponder is located on the instrument console.

Automatic Direction Finder (ADF) Receiver: The ADF is a radio receiver that is used as a navigation aid. A needle located on the radio bearing indicator will point toward the transmission station of the frequency received by the ADF receiver. The ADF receiver is located on the instrument console; the radio bearing indicator is located on the main instrument panel.

Literature Review

In conducting the review of literature, the researcher confined the search to design of workstations, particularly aircraft cockpit workstations, and evaluation of workstation designs, especially computer aided evaluations.

It was particularly interesting to note that controversies involving the layout of the helicopter cockpit discussed in excess of 30 years ago are still being

discussed today. The record of "The Symposium on the Operation and Design Requirements of Helicopters" (Technical Secretariate, International Air Transport Association (IATA), 1953) listed these controversies. One question to be resolved was whether one pilot, two pilots or a pilot and an observer are necessary to safely fly passenger missions. The decision of those in attendance was that as far as design considerations were concerned, the requirement existed for dual flight controls because of training and crew checks. Additionally, the cockpit should be designed so that the aircraft can be flown equally well by one pilot alone. Along these same lines, a controversy existed over whether the captain's seat should be on the right side or the left side of the aircraft (in fixed wing aircraft, the captain sits on the left side; the reverse is true in helicopters). A representative from Sikorsky Helicopter mentioned several historical reasons for the captain's seat being on the right: 1) for weight and balance purposes, especially when flying solo; 2) early aircraft tended to tip over to the left and 3) early configurations had 2 cyclic controls but only one collective control which was located between the two seats. Because of this configuration, most pilots chose to fly in the right seat to be able to grasp the cyclic with the right hand and the collective with the left hand. A representative of the Gyrodyne Company of America (Technical Secretariate, IATA, 1953) went on to explain that a pilot sitting in the left

seat of a helicopter with dual controls will have to either switch hands (grasp the cyclic with the left hand) and tune radios with the right hand or cross the left arm over the right to tune the radios; neither solution was seen as feasible.

Shapiro (1955) gave actual figures for what he considered maximum displacements for the main controls: the cyclic - 16" in fore and aft movement, 12" in sideward movement; the antitorque pedals - 8" movement; collective pitch - 18" from top to bottom. Additionally, Shapiro (1955) presented a standard display arrangement for grouping of flight and engine instruments, which was, incidentally, the same as presented by the British Ministry of Supply (Techincal Secretariate, IATA, 1953). Murphy (1960) gave as one of the principles for the design of a workstation that the physical characteristics of the probable user population be considered in the design phase. He continued, "Compromise in optimum design for operator performance is sometimes necessary, however, due to such considerations as cost, availability of components, and weight and space limitations" (Murphy, 1960). In accepting less than the optimum, a couple of the implications are that the design may be hazardous or that it may cause discomfort to the operator (Murphy, 1960). Perry (1971) connected poor design and layout of the helicopter cockpit to pilot fatigue, a possible extension of the discomfort mentioned by Murphy.

Murphy (1960) was the only person who mentioned an aspect of the layout of a workstation that is critical, especially in an aircraft cockpit. That is the area of design for the ease of maintenance.

Bullock (1974) discussed the importance of designers of driver's compartments and aircraft cockpits having the availability of data representing the functional reach of the potential user population. She continued, "For example, in a cockpit, it is important that all pilots be able to simultaneously to reach the pedals, use the control wheel correctly, see through the windscreen and manipulate the manual controls while restrained by an adequate harness" (Bullock, 1974). The need was demonstrated the following year (Bittner et al., 1975) for the development of an accommodated percentage model to evaluate aircrew cockpit design. Designers had well learned to design for 5th and 95th percentile users, but it was demonstrated that a large percentage of users were not accommodated by the designs. Later that same year, Bittner (1975) illustrated the use of a baseline Computerized Accommodated Percentage Evaluation (CAPE) model for cockpit analysis. The CAPE model and similar models made use of 'link men'--links representing parts of the body. Krause and Kremer (1973) discuss one such model named COMBIMAN (COMputerized BIomechanical MAN-model) and the applications of its use in evaluation workstations.

In the design arena, Bonney and Williams (1977) discuss the use of Controls and Panel Arrangement by Logistical Evaluation (CAPABLE). Through CAPABLE, Bonney and Williams try to minimize an objective function such as distance traveled by positioning "n" controls into "m" possible locations. CAPABLE also uses a weighting factor referred to as 'prominence' to help determine the optimal layout. Bittner (1978) used the CAPE model developed for aircraft cockpits and made the logical extension to the driver's station in the automobile. Aviation Week and Space Technology (1984) reported that because of advances in the technology of avionics, helicopter cockpits are being totally redesigned. Some of the latest changes are vertical scale instruments (instead of round gauges), visual display units, and a single control head for all radio tuning requirements. One company is working on a computer voice entry system. The system would allow the pilot to tune radios, tune the ADF, change transponder codes, call up displays, and enter and recall navigation data. Once this system is operational, one would not have to worry if the aviator population could make many reaches!

Scope of the Study

This study will be limited to the standard OH-58A aircraft as delivered by Bell Helicopter to the Army. The population against which the cockpit dimensions will be tested is that as generated as sample populations from a

Monte Carlo Simulation module that is a subroutine used in the computer evaluation package. The samples are generated from the means, standard deviations and correlation matrix from 12 anthropometric measurements taken from Technical Report 72-52-CE entitled "Anthropometry of U.S. Army Aviators - 1970". The measurements used to define the cockpit were taken from literature from Bell Helicopter and from actual measurements made by the researcher. Any conclusions drawn or recommendations made will pertain only to the OH-58A aircraft. Further, any recommended movement of controls or displays will not have been checked for feasibility, i.e. if the move would be cost effective or if the aircraft would remain within weight and balance limits.

Basic Assumptions

The basic assumptions of the study are as follows:

1. The design data for the cockpit definition are indeed what one would find in a standard OH-58A aircraft.
2. The measurements taken by the researcher are accurate.
3. The Design Eye Point (DEP), although not specified for the OH-58A aircraft, would be in the same position as that specified by the OH-58D aircraft specifications.
4. While flying the aircraft, the pilot/copilot will release his left hand from the collective to make any adjustments to controls regardless of the direction of the reach.

5. While observing from either the pilot's or copilot's station, the non-flyer will make adjustments of controls as necessary with the hand closer the control in question.

6. The main flight controls will be considered primary controls. All other controls used to define the cockpit will be considered secondary controls.

7. All reaches to controls will be attempted with the shoulder harness in the unlocked position.

8. The generated population samples are truly representative of the Army Aviator population in 1970.

9. The crewstation as defined by the researcher is a truly accurate representation of the actual OH-58A aircraft.

Procedures for Collecting Data

Most of the data collected came directly from computer printouts of the results of the accommodation analysis. The data used to define the population came directly from the anthropometric survey of army aviators in 1970. The crewstation definition data came from design specifications from Bell Helicopter and from measurements made on an actual OH-58A aircraft. Standard measuring equipment was utilized.

II. THE CREWSTATION ASSESSMENT OF REACH (CAR-II-A) EVALUATION PROGRAM

Introduction

Through discussions with Dr. Stephen Morrissey, Dr. Alvah Bittner, Dr. Floyd Glenn and Commander William Moroney, the researcher decided to utilize a computerized evaluation tool known as Crewstation Assessment of Reach (CAR). A computer tape of the CAR program along with Technical Report 1400.06B entitled "CAR-II-A Revised Model for Crewstation Assessment of Reach" were provided to the researcher by Dr. Floyd Glenn of Analytics, Inc., in Willow Grove, Pennsylvania. The first task of the researcher was to adapt the CAR program, written in FORTRAN 77 for a CDC computer system, to the IBM mainframe system at Auburn University. Additionally, the structure of the program had to be changed from a flexible interactive mode to a strictly non-interactive mode.

The CAR program is broken down into four basic functional areas as follows: input of operator data, input of data to define a crewstation, performance of an accommodation analysis, and development of a reach envelope. Each of these four areas will now be discussed.

The Operator Sample Option

The logic flow of the operator sample option is shown in Figure 2. The user is given the option to generate an operator sample or to enter actual measurements of operators that are to use the crewstation. The researcher chose the option to generate a sample, so that option will be further explored. When choosing the generate option, the user is given a menu with the six options as shown in Figure 2. Each of these options will now be discussed.

Option number one is the place most users would start. This option is the input option where the user is required to input the means and standard deviations of twelve anthropometric measurements from the population that will be used in the accommodation analysis. The twelve anthropometric measurements are listed in Figure 3. Depictions of these measurements are shown in Appendix A. In addition to the twelve pairs of means and standard deviations, the correlation matrix involving these twelve measurements must be entered.

Option number two is the edit option. This option allows the user to correct entries made in an existing operator file. A print function is also included with this option so the user can check the entries.

Option number three, the save option, is self explanatory. This option allows the user to save the input data on file for use in the accommodation analysis.

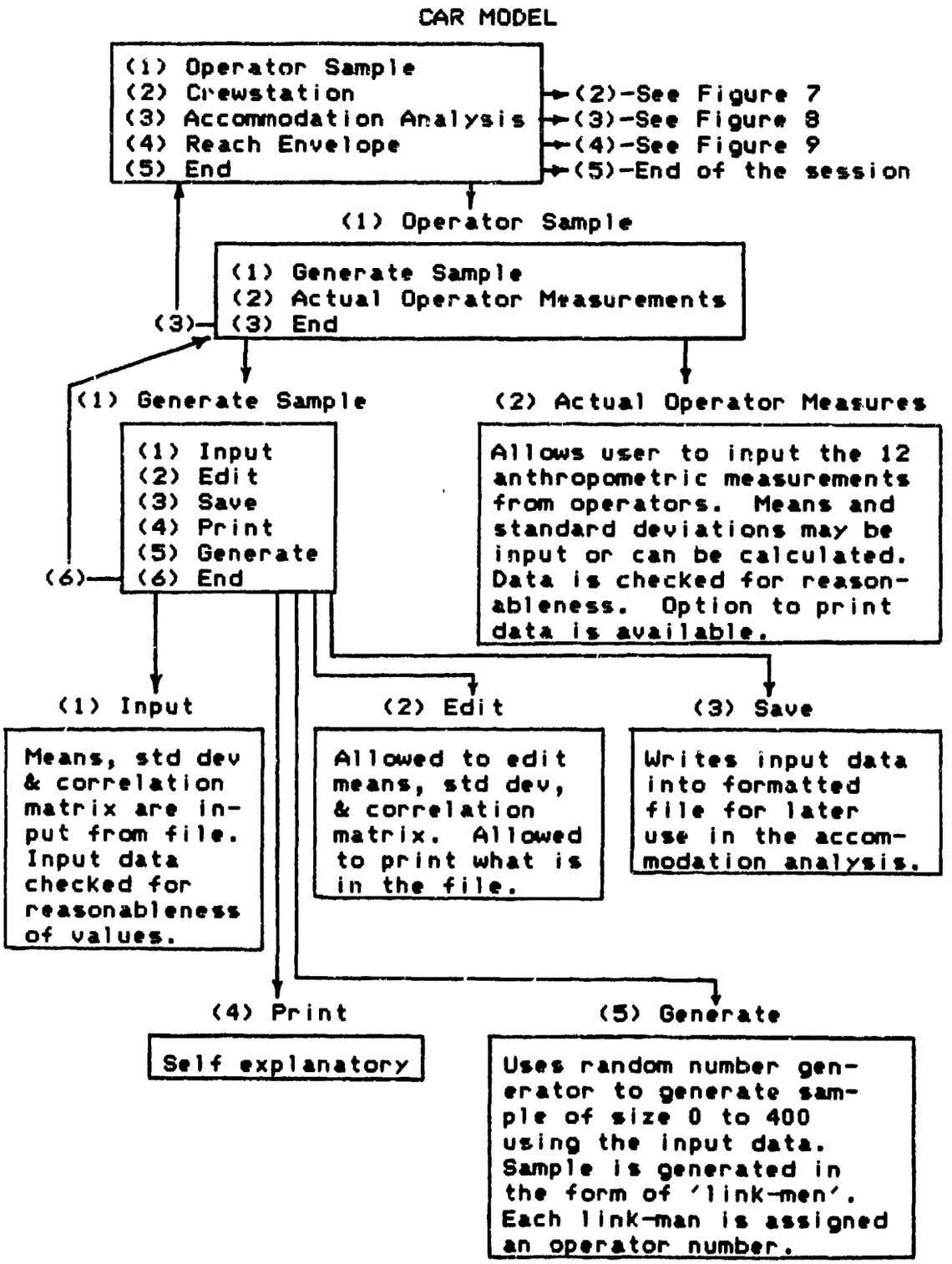


Figure 2. Operator Sample Option

M1=Stature	M7=Shoulder-Elbow Length
M2=Waist Height	M8=Forearm-Hand Length
M3=Sitting Height	M9=Bideltoid Diameter
M4=Eye Height, Sitting	M10=Hip Breadth
M5=Popliteal Height	M11=Foot Length
M6=Buttock-Knee Length	M12=Hand Length

Figure 3. 12 Anthropometric Measurements

Link No.	Link Name	Link No.	Link Name
1	Lumbar	11*	Radial Link
2	Thoracic	12*	Hand Link Clenched
3	Neck-Vertical	13*	Hand Link Finger
4	Neck-Horizontal		Grip
5	Lower Head	14*	Hand Link Extended
6	Eye Midpoint to Head	15*	Pelvic Link
7	Upper Head Link	16*	Femoral Link
8*	Interclavicular Link	17*	Tibial Link
9*	Clavicular Link	18*	Ankle Link
10*	Humeral Link	19*	Foot Link

*Has both left and right links

Figure 4. Link-man Numbering System

Because the CAR program had to be modified to be non-interactive, option two (edit) and option three (save) were not needed as the researcher could edit and save the operator file separately from the CAR program.

Option number four proved to be a useful function. This option allowed the data read from the input file to be printed and therefore checked for accuracy. This was actually a second check as earlier when the means for each anthropometric measurement were entered, an internal check was conducted to determine whether the entered mean was within plus or minus three standard deviations from the mean of the same anthropometric measurement from the 1964 survey of Naval Aviators. Therefore, between the two checks, both the reasonableness of the data and accuracy of the data could be checked.

Option five is the generate option of the generate sample function. This option makes use of a random number generation system to 'create' a sample of operators. The CAR system is set up to generate sample sizes up to 400. The generated sample is made up of 'link-men' (see Figure 5). It is these link-men that are used in the accommodation analysis. The numbering system of the links used in the formulas to determine link lengths of the generated sample are shown in Figure 4. The formulas to transform anthropometric measurements to link lengths are shown in Figure 6.

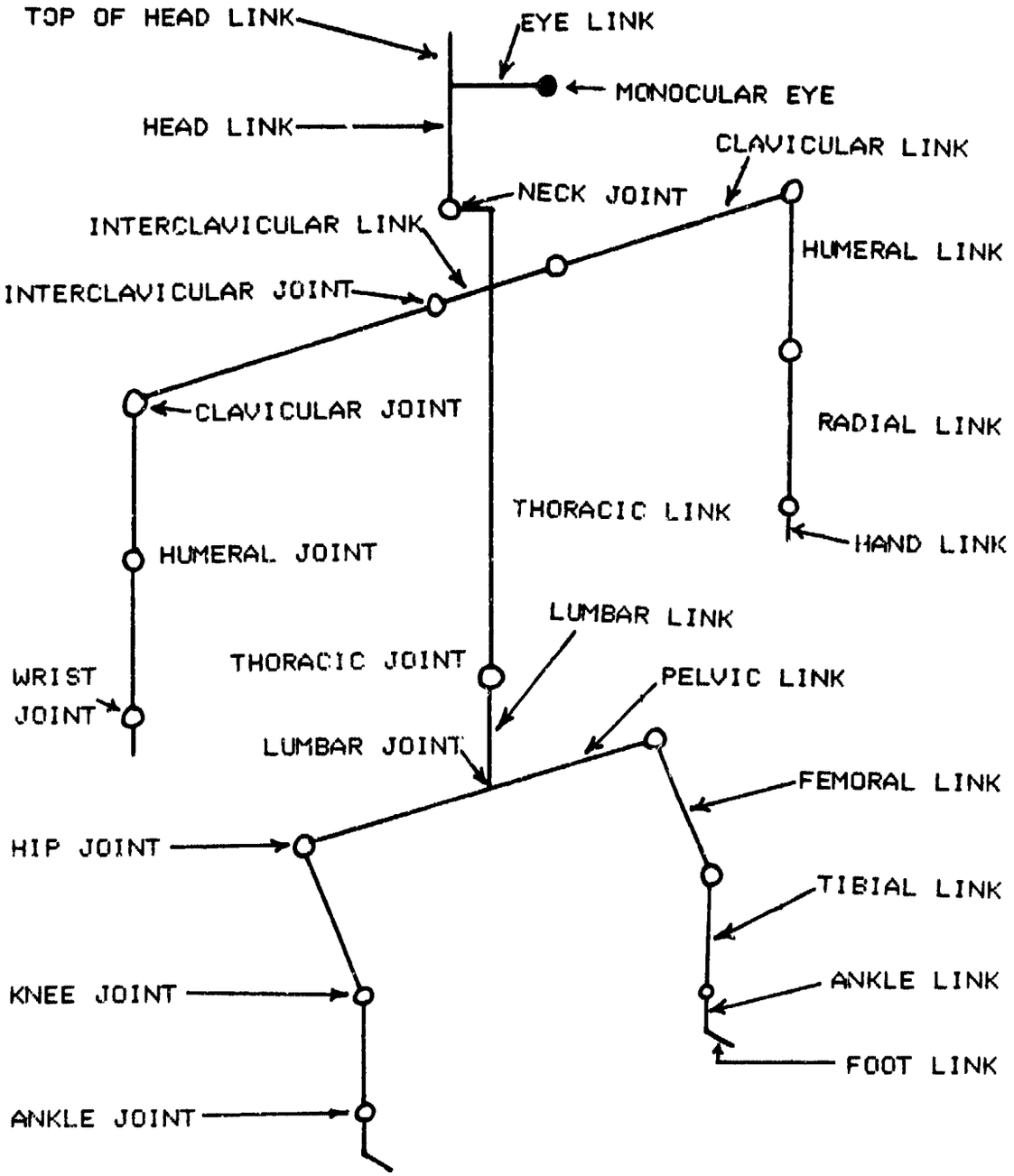


Figure 5. CAR Link-man Model

Link	Defining Equation
L1 =	M2 + 1.0" -(L16 + L17 + L18)
L2 =	.4061 * M4 if M4 <= 25th percentile .3972 * M4 if 25th percentile < M4 < 75th percentile .3906 * M4 if M4 > 75th percentile
L3 =	L5 = .5 * (M1 - M2 - L2 - L7)
L4 =	.5"
L6 =	4.5"
L7 =	L3 - L4
L8 =	1.0"
L9 =	.3980 * M9 if M9 <= 25th percentile .3876 * M9 if 25th percentile < M9 <= 75th percentile .3787 * M9 if M9 > 75th percentile
L10=	.8572 * M7 if M7 <= 25th percentile .8310 * M7 if 25th percentile < M7 <= 75th percentile .8131 * M7 if M7 > 75th percentile
L11=	.5784 * M8 if M8 <= 25th percentile .5673 * M8 if 25th percentile < M8 <= 75th percentile .5577 * M8 if M8 > 75th percentile
L12=	.5607 * M12
L13=	.6248 * M12
L14=	.9346 * M12
L15=	.5087 * M10
L16=	.7317 * M6 if M6 <= 25th percentile .7240 * M6 if 25th percentile < M6 <= 75th percentile .7173 * M6 if M6 > 75th percentile
L17=	.9487 * M10
L18=	4.4" + .15 (L11 - M11) / Std Dev of M11
L19=	.6916 * M11 if M11 <= 25th percentile .6838 * M11 if 25th percentile < M11 <= 75th percentile .6770 * M11 if M11 > 75th percentile

Figure 6. Link Length Equations

The Crewstation Option

The logic flow of the crewstation option is shown in Figure 7. There are the four basic options within this function plus the option to return to the higher menu. Each of these options will now be discussed.

Option one, like that of the operator sample option, involves the input of data. This option is very flexible in that it gives the option of selecting one of several points from which to anchor the crewstation to be defined. Also, aside from describing the right hand coordinate system, the user is allowed to define the coordinate system to be used and the CAR program will in turn transform the crewstation to the internal coordinate system from which it accomplishes the accommodation analysis. A design eye point (DEP) must be specified in the crewstation definition, although this point does not necessarily have to be the anchor point. A line of sight (LOS) angle must also be specified along with data to fully describe the seat, its angles and adjustments (if any). The crewstation option is equipped to handle up to the definition of 50 controls with the following information (if applicable) gathered for each control defined: the control name, the control location (in x,y,z coordinates), the body part used to operate the control (either or both hands, either or both feet), the type of grip used to operate the control, whether the shoulder harness is locked while operating the control, whether it is a primary

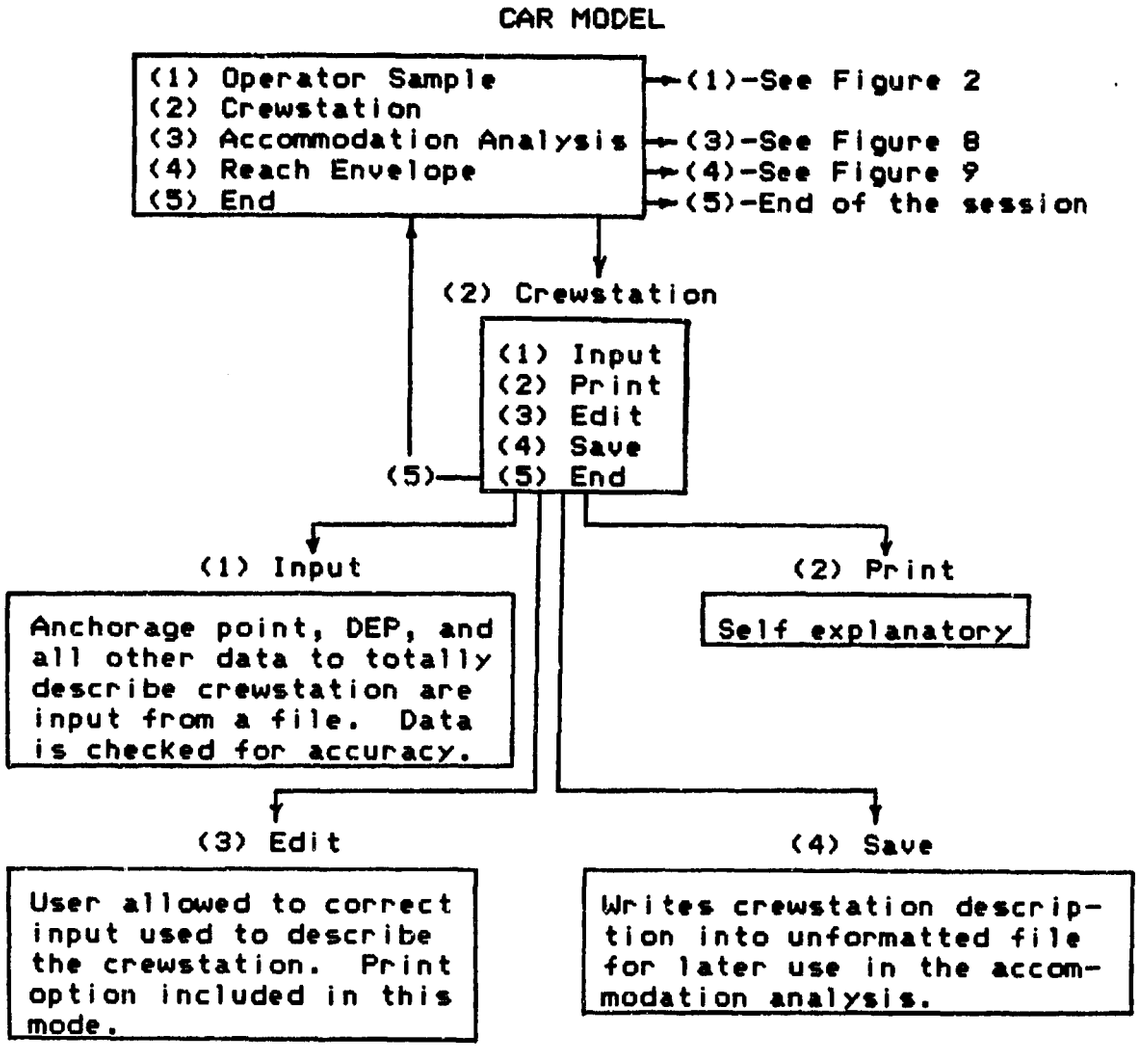


Figure 7. Crewstation Option

control, and the adjustable location of the control. There is also the option to evaluate head clearance by defining the minimum allowed head clearance, the helmet thickness and a point on the plane of the overhead obstruction.

The second option, print, is self explanatory. However, as with the operator sample option, the print option allows the user to view his input to ensure the data were entered correctly.

The third option allows the user to edit the data used to define the crewstation. Included in this option is the ability of the user to print the data in the crewstation file. Again, because the CAR program had to be modified not to be interactive, this option was not useful to the researcher.

The fourth option was a most useful option. Because the crewstation could have up to 50 controls defined, the accommodation analysis routine 'looked' for 50 names of controls, 50 locations of controls, etc. Therefore, the save option of the crewstation function wrote to file the definitions of the crewstation using unformatted write statements. This filled in blanks for the names of the undefined controls and filled in zeroes for their locations. Thus, even though the researcher was required to create a file defining the crewstation to be read into the system during the input option, it was easier to let the CAR

crewstation save option save the crewstation definition and put in the required blanks and zeroes in the proper places.

The Accommodation Analysis Option

The accommodation analysis option is, as the name suggests, the main function of the CAR program. The logic of this option is shown in Figure 8. This function first reads into memory the crewstation defined in the crewstation option. The user is then given the option to determine which controls will be used in the analysis. The user also is allowed to choose the sample size to be evaluated in the crewstation from the earlier sample that was generated and saved in the operator sample option. To allow for more realism, the user is also given the option to specify the type of clothing worn by the sample with unclad, summer flight clothing and winter flight clothing being the options. The user may also use the entire sample size specified or specify a certain percentile range such as 5th to the 95th percentile to be evaluated. Additionally, the user may further restrict the analysis to those operators that may adjust to the DEP or LOS. The accommodation analysis function then analyzes the data and prints out the results according to the information specified by the user.

The Reach Envelope Option

The reach envelope option is very similar to the accommodation analysis option. The logic for the envelope

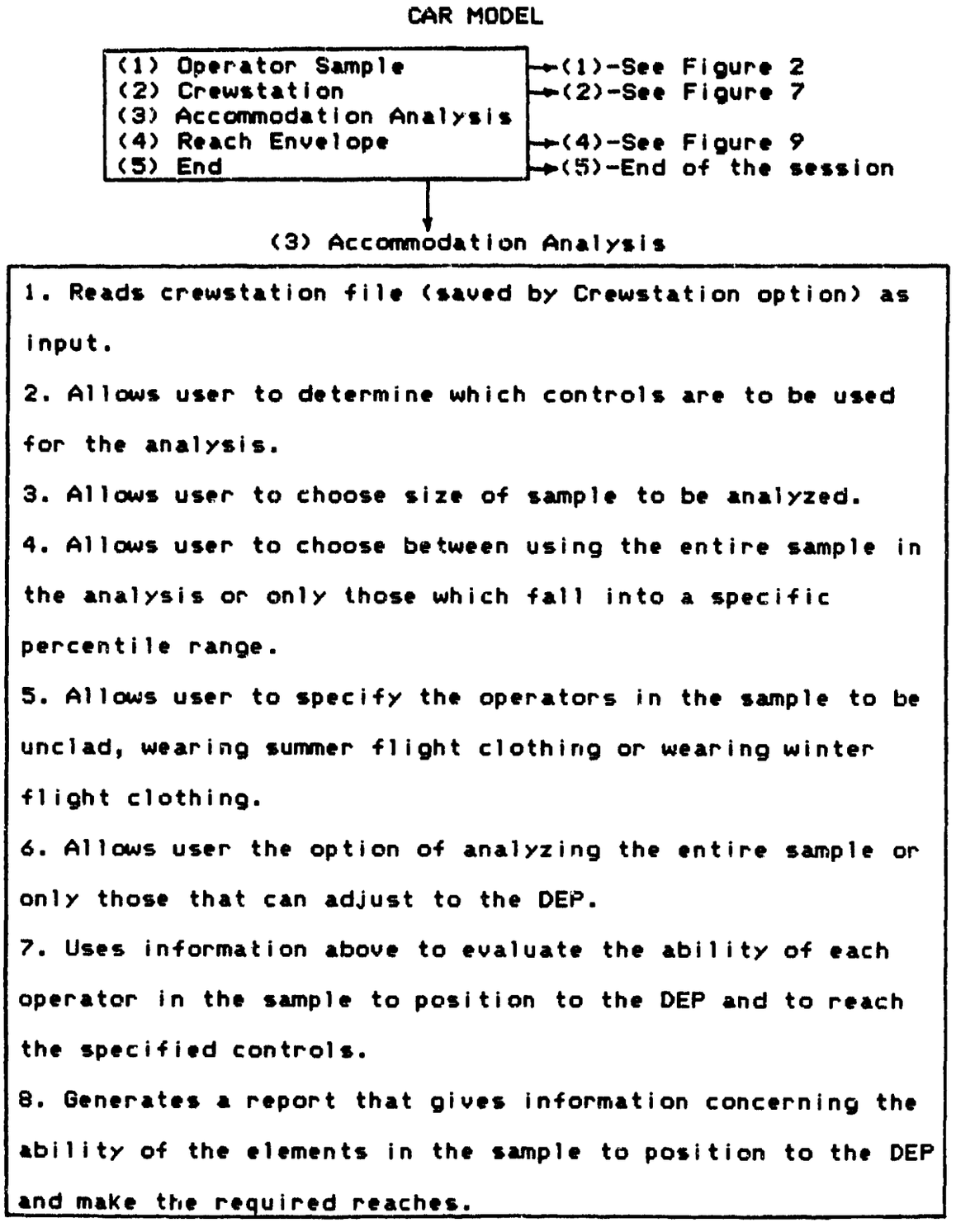
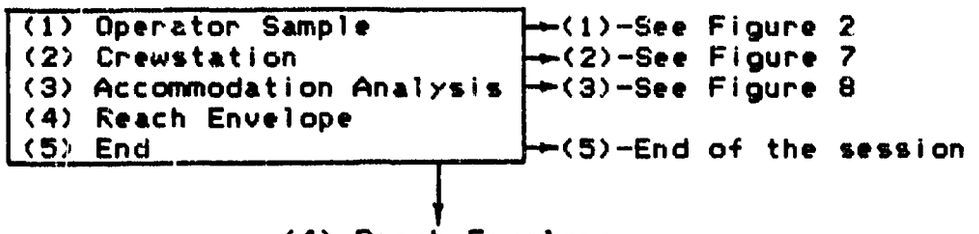


Figure 8. Accommodation Analysis Option

option is shown in Figure 7. This option also starts by reading into memory the crewstation definition as saved by the crewstation option. The user again is allowed to choose the sample size and the mode of dress of the operators- unclad, summer flight clothing or winter flight clothing. The sample again may consist of the entire sample size or only those able to adjust to the DEP or LOS. The user is also allowed to specify the reach envelope that is desired. Some of the options include the envelope created by all reaches with the shoulder harness locked, that created with the shoulder harness unlocked, that created by left side reaches, that created by right side reaches and that created by reaches by type of grip.

CAR MODEL



(4) Reach Envelope

1. Reads crewstation file (saved by Crewstation option) as input.
2. Allows user to choose size of sample to be analyzed.
3. Allows user to specify the operators in the sample to be unclad, wearing summer flight clothing or wearing winter flight clothing.
4. Allows user the option of analyzing the entire sample or only those that can adjust to the DEP.
5. Allows user to specify the reach envelope desired:
   a) with shoulder harness locked
   b) with shoulder harness unlocked
   c) left side reaches
   d) right side reaches
   e) reaches restricted to the type of grip (clenched, fingertip, or extended finger).

Figure 9. Reach Envelope

III. CREWSTATION DEFINITION AND OPERATOR SAMPLE GENERATION

Defining the Crewstation

The CARII software is very flexible in that it allows the user to input the controls and other features that define the crewstation according to any coordinate system. The program then defines the crewstation according to an internal system, makes the analysis, and converts back to the user's system for output. Regardless of whether the crewstation to be defined has a DEP, however, the user is required to input the coordinates of a DEP. Additionally, the user is required to enter a line of sight (LOS) angle from the DEP to a device such as a Heads Up Display (HUD). The CAR program allows for a possible seven anchorage points (the origin of the coordinate system) as follows: 1) DEP, 2) seat, 3) foot while seated, 4) foot while standing, 5) hip, 6) shoulder while seated, and 7) shoulder while standing. It is from this chosen anchorage point that all other points in the crewstation are defined. Additionally, the following seat information is required: seat back angle, seat pan angle, and (if the seat is adjustable) the coordinates of the seat in the down back position, the down front position, the up front position and the up back position. If the seat is not adjustable, the coordinates of the

seat reference point (SRP) are assigned to the down back position.

Each of the controls to be defined (up to a maximum of 50) are also input in several steps. The name of the control, its location (with respect to the previously defined anchor point), the body part that uses the control (left hand, right hand, both hands, left foot, right foot, both feet), the grip used (clenched, fingertip, extended finger-for hand controls only), the shoulder harness condition (locked or unlocked), the importance of the control (primary or not), and the adjustable location of the control are input for each control.

A diagram of the OH-58A cockpit taken from the Operator's Manual (and modified by the researcher) is shown in Figure 10. Figure 11 depicts the overhead console. For the purposes of this study, the researcher chose to define the OH-58A cockpit as three different crewstations. The first defines the OH-58A cockpit as seen from the pilot's station, assumes the pilot is flying the aircraft, and uses the pilot's SRP as the anchor point for the crewstation. By saying that it is assumed that the pilot is flying the aircraft it is meant that the pilot will keep the right hand on the cyclic and reach all other controls with the left hand or the feet as appropriate. The only exception to that was the reach for the emergency door release. Due to the location

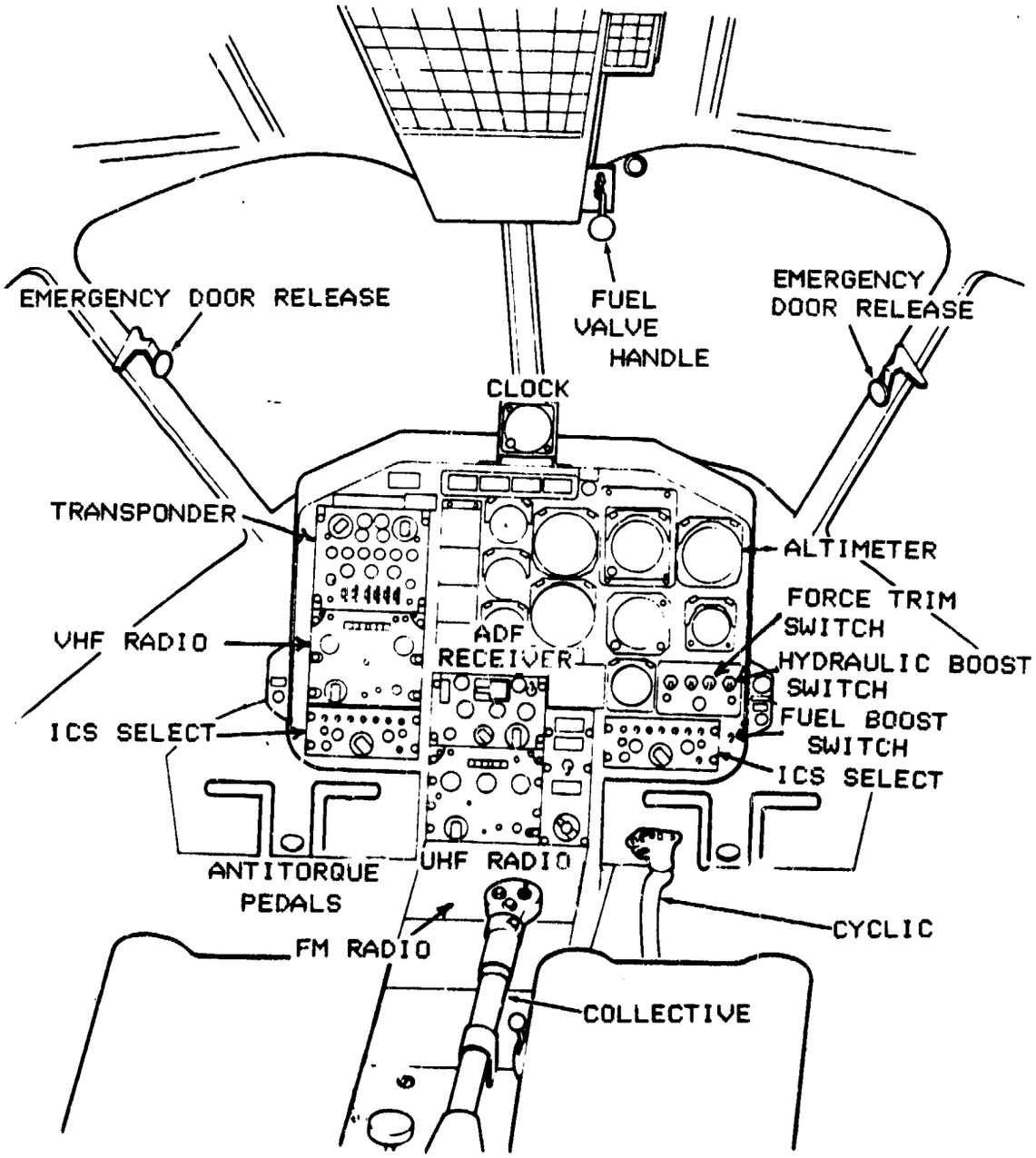


Figure 10. OH-58A Cockpit

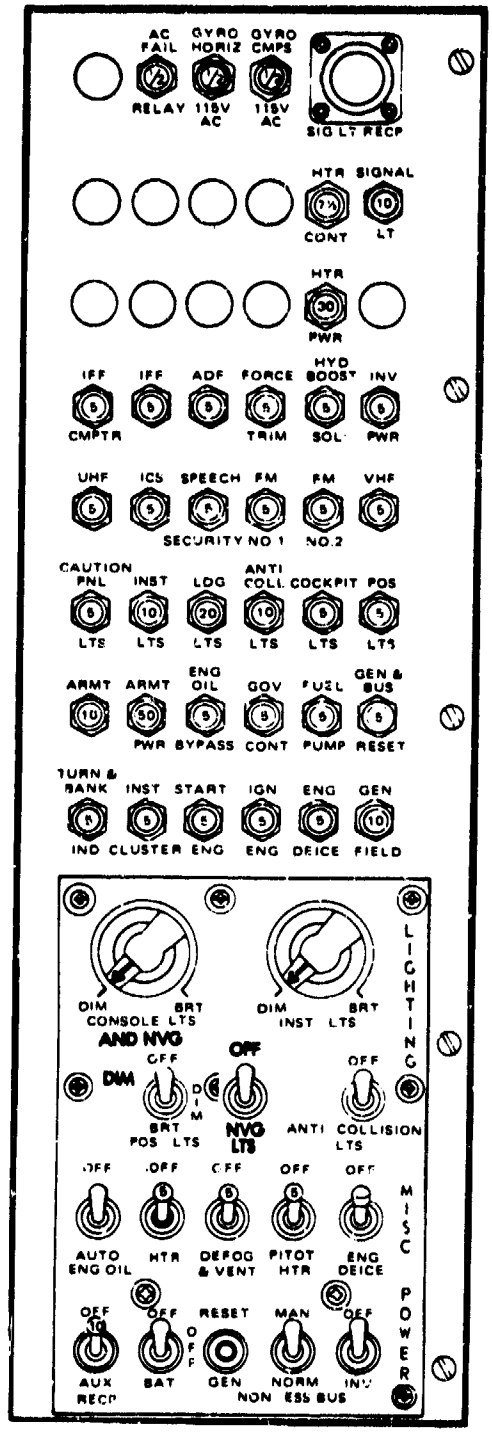


Figure 11. OH-58A Cockpit Overhead Console

of that handle, it is extremely doubtful that the reach would be made with the left hand.

The researcher chose a total of 24 controls to examine in the analysis of the OH-58A cockpit. Several of the controls were difficult to define because the user is only given two locations with which to define each control and several controls could be routinely expected to be moved in many directions. The controls the researcher chose to define and the reason behind the location(s) chosen follows.

The first control defined was the cyclic. The two locations chosen to define the cyclic were a central location where the cyclic could be expected to be positioned for straight and level flight and a far forward position to determine if the operators could move the control out away from the body.

The definition of the collective had to be altered because the CARII program would not accept the locations of the control as input by the researcher originally. As a check against what the program calls 'unreasonable control movement', the adjustable location of the control is checked against the main location of the control according to the following:

$$[(X1-X2)^2 + (Y1-Y2)^2 + (Z1-Z2)^2]^{.5} <= 10$$

When defining the position of the hand on the collective in the full down position (where it would be during ground

operations and in emergency autorotation) and the full up position (where it may be at the end of an autorotational descent), the limit of 10 imposed by the program was exceeded. In order to make the program accept the definition of the collective, the Y and Z coordinates (X did not change) of the higher location were lowered by the same amount so that the control definition was accepted.

The left and right antitorque pedals were defined using the closest position of the pedals with the pedal adjustment in the closest and the farthest pedal adjustment with the pedal adjustment in the farthest position. The reason behind these decisions was to allow the short-legged operators a chance to be accommodated as well as the long-legged ones.

Several of the remaining controls, for example the fuel boost switch and the hydraulic boost switch, were defined by their exact locations. The remaining controls, for example the radios, were defined using their midpoints. The reason for this decision was that the radios had several control knobs, and several other less used switches were within very close proximity to each other. For the computer printout defining the OH-58A cockpit from the pilot's perspective, see Appendix B.

The second definition of the OH-58A cockpit used the copilot's (left seat) perspective. The anchor point used was the SRP of the copilot's seat. In this case, as with

the pilot, it is assumed that the copilot is flying the aircraft and that the right hand will be on the cyclic and therefore all reaches will be made with the left hand. It would be expected that this decision will probably lead to very low percentages of those able to make reaches because nearly all of the reaches would be across the body. However, it is highly unlikely that one would be flying in the left seat without a rated pilot (or student pilot) in the right seat to make any necessary reaches that would be difficult for the copilot to make. Additionally, some copilots are known to switch the control of the cyclic to the left hand while making adjustments of another control with the right hand. The third definition of the OH-58A crewstation helps compensate for the unreality of this definition. The computer printout for the definition of the OH-58A cockpit from the perspective of the flying copilot is shown in Appendix C.

The third definition of the OH-58A cockpit is that from the point of view of an aerial observer. The aerial observer would sit in the copilot's (left) seat, and therefore the crewstation is defined exactly as it is for the copilot with the exception that the reaches are attempted with the closest hand or foot. The computer printout for the definition of the OH-58A cockpit from the perspective of the aerial observer is shown in Appendix D.

Generating the Operator Sample

In order to generate an operator sample, the CARII program requires that the means and standard deviations of the 12 previously mentioned anthropometric measurements are entered into memory from file or interactively. Additionally, the correlation matrix relating the measurements must be input. Through the use of these data and the use of a random number generation system, a sample of link-men will be generated with the sample size being user directed up to 400. Because the crewstation defined was that of an Army helicopter cockpit, the researcher chose the means and standard deviations of the 12 required measurements from the 1970 anthropometric survey done on Army aviators. The correlation matrix data used was that of the 1964 survey of Navy aviators. The researcher chose to generate a sample size of 200. The computer printout of the operator data used to generate the sample used in the analysis portion is shown in Appendix E.

IV. RESULTS

The Operator Sample

The researcher chose to generate a sample size of 200. From the 200 generated in the sample, the first 50 link-men were chosen to be used in the accommodation analysis. Additionally, only those link-men in the range between the 5th and 95th percentile of each of the 12 anthropometric measurements were evaluated in the crewstation. That reduced the sample size to 29. The 21 link-men that failed to meet the 5th through 95th percentile requirements and the measures that they failed to meet are shown in Table 1. To ensure equal comparisons, the same operator sample was used in the analysis of all three of the defined versions of the OH-58A cockpit.

The Crewstations Analyses

All 24 controls defined in each of the crewstations were evaluated for reach in the analyses. The summer clothing option was chosen for all analyses as a compromise between the unclad option and the winter clothing option. The vision accommodation output was ignored as the OH-58A was without a DEP and therefore an estimation of the DEP was input from the specifications of the OH-58D model. The LOS data were also ignored as the input of the -13 degrees was an estimation on the part of the researcher. For the control

Table 1

Sample Link-men

Outside the 5th and 95th Percentiles

Measurement Number	Number of Link-men	Link-men Identification
1	7	12 14 22 24 28 43 44
2	4	1 7 13 40
3	0	0
4	1	15
5	4	5 34 36 46
6	0	0
7	2	6 37
8	1	11
9	0	0
10	1	30
11	1	39
12	0	0

summary, all reaches are checked for Zone 3 accommodation, Zone 3 being for the shoulder harness in the unlocked position. The percentage of the 29 link-men able to make the required reaches to the 24 controls are shown in Tables 2 and 3 for the pilot's crewstation. The same data for the copilot's crewstation are shown in Tables 4 and 5. The data for the observer are shown in Tables 6 and 7. Tables 8 and 9 give a comparison between the three definitions of the same crewstation. The computer printout for the pilot's crewstation analysis is shown in Appendix F. Appendix G contains the analysis of the copilot's crewstation while the observer's printout is shown in Appendix H.

Table 2

Link-men Able to Make Required Reaches,

Controls 1 Through 12

OH-58A Cockpit (Pilot)

Control Number	Control Name	Percentage of Link-men
1	Cyclic	100
2	Collective	100
3	Right Antitorque Pedal	34
4	Left Antitorque Pedal	100
5	Fuel Boost Switch	100
6	Pilot ICS Select	89
7	Force Trim Switch	100
8	Hydraulic Boost Switch	100
9	Altimeter Set Knob	100
10	UHF Radio	75
11	VHF Radio	100
12	Transponder	100

Table 3

Link-men Able to Make Required Reaches,

Controls 13 Through 24

OH-58A Cockpit (Pilot)

Control Number	Control Name	Percentage of Link-men
13	Clock	100
14	Inverter Switch	100
15	Battery/Generator Switches	100
16	Row 2 Switches, Overhead	89
17	Row 3 Switches, Overhead	65
18	Lighting Control Knobs	93
19	Hydraulic Boost Circuit Breaker	75
20	Fuel Valve Handle	100
21	Emergency Door Release	100
22	Caution Test/Reset Switch	100
23	FM Radio	100
24	ADF Receiver	96

Table 4

Link-men Able to Make Required Reaches,

Controls 1 Through 12

OH-58A Cockpit (Copilot)

Control Number	Control Name	Percentage of Link-men
1	Cyclic	100
2	Collective	100
3	Right Antitorque Pedal	34
4	Left Antitorque Pedal	100
5	Fuel Boost Switch	0
6	Copilot ICS Select	75
7	Force Trim Switch	0
8	Hydraulic Boost Switch	0
9	Altimeter Set Knob	0
10	UHF Radio	0
11	VHF Radio	100
12	Transponder	100

Table 5

Link-men Able to Make Required Reaches,

Controls 13 Through 24

OH-58A Cockpit (Copilot)

Control Number	Control Name	Percentage of Link-men
13	Clock	100
14	Inverter Switch	100
15	Battery/Generator Switches	100
16	Row 2 Switches, Overhead	100
17	Row 3 Switches, Overhead	100
18	Lighting Control Knobs	96
19	Hydraulic Boost Circuit Breaker	0
20	Fuel Valve Handle	34
21	Emergency Door Release	100
22	Caution Test/Reset Switch	55
23	FM Radio	34
24	ADF Receiver	0

Table 6

Link-men Able to Make Required Reaches,

Controls 1 Through 12

OH-58A Cockpit (Observer)

Control Number	Control Name	Percentage of Link-men
1	Cyclic	100
2	Collective	100
3	Right Antitorque Pedal	34
4	Left Antitorque Pedal	100
5	Fuel Boost Switch	100
6	Copilot ICS Select	75
7	Force Trim Switch	100
8	Hydraulic Boost Switch	100
9	Altimeter Set Knob	100
10	UHF Radio	68
11	VHF Radio	100
12	Transponder	96

Table 7

Link-men Able to Make Required Reaches,

Controls 13 Through 24

OH-58A Cockpit (Observer)

Control Number	Control Name	Percentage of Link-men
13	Clock	100
14	Inverter Switch	100
15	Battery/Generator Switches	96
16	Row 2 Switches, Overhead	55
17	Row 3 Switches, Overhead	20
18	Lighting Control Knobs	58
19	Hydraulic Boost Circuit Breaker	34
20	Fuel Valve Handle	100
21	Emergency Door Release	100
22	Caution Test/Reset Switch	100
23	FM Radio	100
24	ADF Receiver	89

Table 8

Link-men Able to Make Required Reaches,

Comparison by Cockpit,

Controls 1 Through 12

Control	Control Name	Pilot	Copilot	Observer
1	Cyclic	100	100	100
2	Collective	100	100	100
3	Right Antitorque Pedal	34	34	34
4	Left Antitorque Pedal	100	100	100
5	Fuel Boost Switch	100	100	0
6*	ICS Select	89	75	75
7	Force Trim Switch	100	0	100
8	Hydraulic Boost Switch	100	0	100
9	Altimeter Set Knob	100	0	100
10	UHF Radio	75	0	68
11	VHF Radio	100	100	100
12	Transponder	100	100	96

*Pilot to pilot's ICS control; copilot & observer to copilot's ICS control.

Table 9

Link-men Able to Make Required Reaches,

Comparison by Cockpit,

Controls 13 Through 24

Control	Control Name	Pilot	Copilot	Observer
13	Clock	100	100	100
14	Inverter Switch	100	100	100
15	Battery/Generator	100	100	96
16	Row 2 Switches, Overhead	89	100	55
17	Row 3 Switches, Overhead	65	100	20
18	Lighting Control Knobs	93	96	58
19	Hydraulic Boost C.B.	75	0	34
20	Fuel Valve Handle	100	34	100
21*	Emergency Door Release	100	100	100
22	Caution Test/Reset	100	55	100
23	FM Radio	100	34	100
24	ADF Receiver	96	0	89

*Pilot to the right door; copilot & observer to the left door.

V. DISCUSSION

The Single Person Crewstation

The results of the accommodation analyses, which looked at the OH-58A cockpit from three different single operator perspectives, appeared to be fairly accurate with a few exceptions. The data as presented in a diagram from Bell Helicopter showed that the antitorque pedals were not equally spaced on a center line through the seat reference point. Perhaps these data led to the discrepancy of the percentage accommodated by each of the pedal locations. A probable contributing factor to the zero accommodation to the pedals in the adjustable location was that the researcher chose the furthest position of the pedal travel with the furthest adjustment of the pedals. Regardless of the position of the adjustment, full pedal travel of either pedal is very rarely required.

Extending the Results to the Shared Crewstation

To demonstrate the use of CARII with a shared crewstation, the researcher performed an accommodation analysis with one of the 'controls', the UHF Radio, repositioned to two alternate locations without examining the design feasibility of making such moves. The researcher defined the main location to be exactly one inch higher than the actual

Table 10

Link-men Able to Make Required Reaches,

Comparison by Cockpit,

Control Number 10

Control Name	New Location	% Accommodated Actual	% Accommodated New
UHF Radio (Pilot)	1" Higher	75	93
UHF Radio (Pilot)	1" Higher 1" Right	75	93
UHF Radio (Copilot)	1" Higher	68	0
UHF Radio (Copilot)	1" Higher 1" Right	68	0
UHF Radio (Observer)	1" Higher	0	89
UHF Radio (Observer)	1" Higher 1" Right	0	89

location. For the adjustable location, the researcher input the coordinates of a move one inch higher (as above) and one inch to the right of the actual location. The results of the new analyses compared to the original analyses are shown in Table 10. The computer printouts are shown in Appendix I.

In looking at Table 10, one can easily see that the designer can utilize a evaluation tool such as the CARII program and make an evaluation of the design by determining how changing the positions of controls affects each of the operators in the shared crewstation. In the case of repositioning the UHF radio to either of the two 'proposed' locations, the percentage of the pilots able to reach the radio increased dramatically with even a greater increase in the percentage of observers able to make the reach. Therefore, if the designer is given a priority of controls by operator station, a design which is greater able to meet the user's needs can be attained. Additionally, the designer could ascertain if changing the type of reach (extended finger versus fingertip, for example) would improve the percentage accommodated and therefore specify a control requiring that movement for operation.

The criterion for duplicate controls could also be gotten from the analysis of the UHF Radio. If, for example, the requirement existed from the user that 85% of users from either seat should be able to use the UHF Radio, the original location would not meet the requirement for either crew

position. However, the new design location, if feasible, would demonstrate that one UHF Radio, if placed in that position, would more than meet the design requirements.

VI. CONCLUSIONS and RECOMMENDATIONS

Conclusions

The Crewstation Assessment of Reach (CARII) evaluation program was used to define a shared crewstation, that of an OH-58A cockpit. Additionally, the CARII program was used to generate the operator sample against which the design of the the crewstation was evaluated. The printouts gave (according to the program) the percentage of operators able to make the required reaches in the crewstations.

The analyses given as output by the CARII program were not validated by the researcher. However, the researcher did show that use of the results of the analyses could be used to better the design of the workstation by examining the reaches of operators in both workstations simultaneously. As shown in the comparison of alternate locations for the UHF Radio, the researcher demonstrated that controls could be evaluated as they are placed in various positions in the crewstation with the final placement being obtained through the use of a priority system. Additionally, the CARII program could be used to determine whether to have duplicate controls by examining the analysis data, as done by the researcher, and then establishing minimum criteria for reaches from each crew position.

Recommendations

As a result of this research, the following recommendations are made:

1. The CARII program should be validated for use in a shared crewstation such as a helicopter cockpit.
2. The restriction of the allowable movement of a control from the main control location to its adjustable location should be examined for validity.
3. With a specialized crewstation like that of a helicopter, perhaps the need to include up to four anchor points (seat, left foot, right foot, and right hand for example) should be examined. When a pilot is at the flight controls, each of these extremities is restricted to a specific area.
4. A priority system for the placement of controls in the cockpit must be established for use in the design stage.
5. Minimum criteria for the percentage accommodated by each control location must be established for use in the design stage so the requirement for duplicate controls can be established.
6. Link equations should continue to be refined to include the female population.

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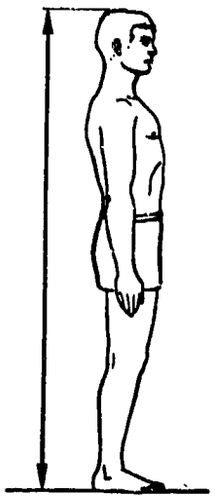
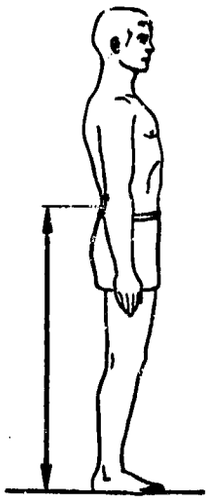
APPENDICES

APPENDIX A

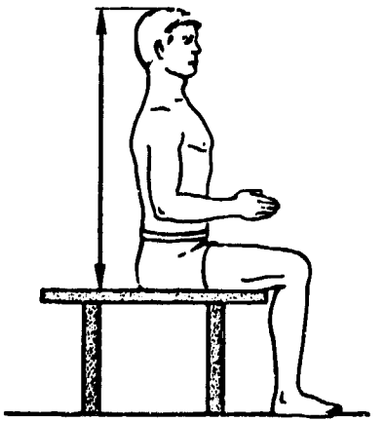
ANTHROPOMETRIC MEASUREMENTS



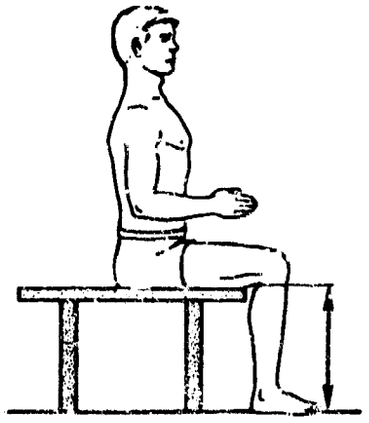
STATURE



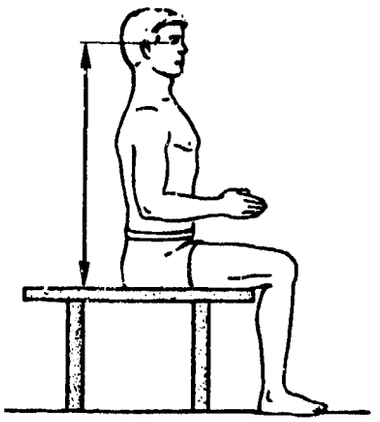
WAIST HEIGHT



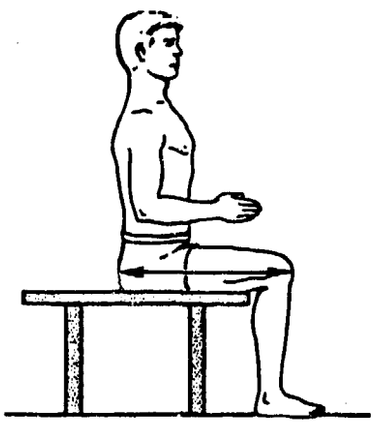
SITTING HEIGHT



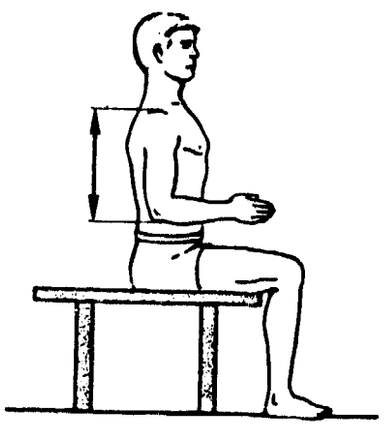
POPLITEAL HEIGHT



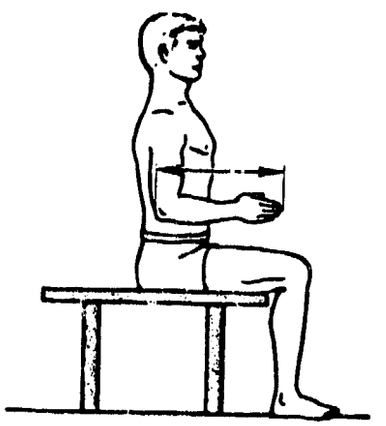
EYE HEIGHT, SITTING



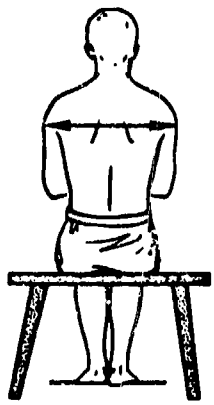
BUTTOCK-KNEE LENGTH



SHOULDER-ELBOW LENGTH



FOREARM-HAND LENGTH



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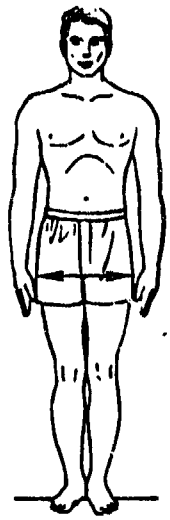
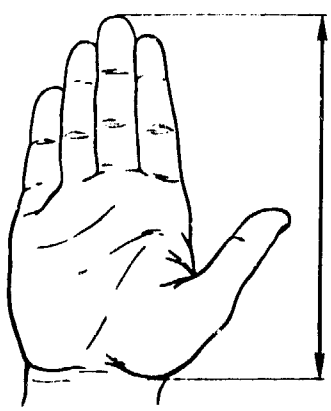


HIP BREADTH

FOOT LENGTH



HAND LENGTH

APPENDIX B

OH-58A COCKPIT-PILOT

```
CREWSTATION ASSESSMENT OF REACH (CAR) MODEL

CAR(1-USER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--
        2

CREW FUNCTIONS(1-INPUT,2-PRINT,3-EDIT,4-SAVE,5-END)--
  1
INPUT MODE(1=INTERACTIVE;2=FILE)--
        1
CREW STATION DESCRIPTION -
        'OH-59A COCKPIT-PILOT'
ANCHORAGE(1-DEP,2-SEAT,3-FOOT SEATED,4-FOOT STAND,
  5-HIP,6-SHOULDER-SEATED,7-SHOULDER-STAND)?--
  2
DESIGN EYE POINT:
DEP(X,Y,Z) -
     0.00      3.90     33.03
DEP IN UP DIRECTION(X,Y,Z) -
     0.00      3.90     43.03
DEP IN FORWARD DIRECTION(X,Y,Z) -
     0.00     13.90     33.03
LINE OF SIGHT ANGLE -
    -13.00
SEAT BACK ANGLE -
      9.00
SEAT PAN ANGLE -
      9.00
HARNESS % -
     50.00
SEAT REF POINT DOWN-BACK(X,Y,Z)-
       0.00          0.00          0.00
CONTROL NAME -
        CYCLIC
LOCATION(X,Y,Z) -
       0.00         19.50         11.61
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
        2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
        1
HARNESS(1-LOCK,2-UNLOCK)--
        2
PRIMARY(1-YES,2-NO)--
        1
ADJUSTABLE LOCATION (X,Y,Z)--
       0.00         25.55         10.76
       6.11         10.00
CONTROL NAME -
        COLLECTIVE
LOCATION(X,Y,Z) -
     -10.80         17.30          0.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
        1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
        1
HARNESS(1-LOCK,2-UNLOCK)--
        2
```

```
PRIMARY(1-YES,2-NO)--
        1
ADJUSTABLE LOCATION (X,Y,Z)--
      -10.80        12.47         0.75
        9.99        10.00
CONTROL NAME -
        'RT ANTITORQUE PED
LOCATION(X,Y,Z) -
        8.00        32.65        -6.26
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
        5
PRIMARY(1-YES,2-NO)--
        1
ADJUSTABLE LOCATION (X,Y,Z)--
        4.00        32.15        -7.76
        9.62        10.00
CONTROL NAME -
        'LFT ANTITORQUE PED
LOCATION(X,Y,Z) -
       -5.50        32.65        -6.26
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
        4
PRIMARY(1-YES,2-NO)--
        1
ADJUSTABLE LOCATION (X,Y,Z)--
       -5.50        32.15        -7.76
        9.62        10.00
CONTROL NAME -
        'FUEL BOOST SW
LOCATION(X,Y,Z) -
       -0.88        30.00         7.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
        1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
        3
HARNESS(1-LOCK,2-UNLOCK)--
        2
PRIMARY(1-YES,2-NO)--
        2
ADJUSTABLE LOCATION (X,Y,Z)--
       -0.88        30.00         7.13
        0.00        10.00
CONTROL NAME -
        'PILOT ICS SELECT
LOCATION(X,Y,Z) -
       -4.13        30.00         6.63
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
        1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
        2
HARNESS(1-LOCK,2-UNLOCK)--
        2
PRIMARY(1-YES,2-NO)--
        2
ADJUSTABLE LOCATION (X,Y,Z)--
       -4.13        30.00         6.63
        0.00        10.00
CONTROL NAME -
        'FORCE TRIM SW
LOCATION(X,Y,Z) -
```

```
        -1.88          30.00          10.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           3
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
        -1.88          30.00          10.13
         0.00          10.00
CONTROL NAME -
         'HYD BOOST SW
LOCATION(X,Y,Z) -
        -0.88          30.00          10.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           2
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
        -0.88          30.00          10.13
         0.00          10.00
CONTROL NAME -
         'ALT SET KNOB
LOCATION(X,Y,Z) -
        -3.13          30.00          15.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           2
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
        -3.13          30.00          15.13
         0.00          10.00
CONTROL NAME -
         'UHF RADIO
LOCATION(X,Y,Z) -
       -13.32          30.00           4.63
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           2
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
       -13.32          30.00           4.63
         0.00          10.00
CONTROL NAME -
         'VHF RADIO
LOCATION(X,Y,Z) -
```

```
      -19.88          30.00          11.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           2
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
      -19.88          30.00          11.13
        0.00          10.00
CONTROL NAME -
         TRANSPONDER
LOCATION(X,Y,Z) -
      -19.88          30.00          16.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           2
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
      -19.88          30.00          16.13
        0.00          10.00
CONTROL NAME -
         'CLOCK
LOCATION(X,Y,Z) -
       -8.13          30.00          22.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           3
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
       -8.13          30.00          22.13
        0.00          10.00
CONTROL NAME -
         'INVERTER SW
LOCATION(X,Y,Z) -
      -10.25          11.50          36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           3
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
      -10.25          11.50          36.00
        0.00          10.00
CONTROL NAME -
         'BAT/GEN SWS
LOCATION(X,Y,Z) -
```

```
      -12.13          11.50          36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           3
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
      -12.13          11.50          36.00
        0.00          10.00
CONTROL NAME -
        'ROW 2 SW, OVRHD
LOCATION(X,Y,Z) -
      -12.13           9.13          36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           3
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
      -12.13           9.13          36.00
        0.00          10.00
CONTROL NAME -
        'ROW 3 SW,OVRHD
LOCATION(X,Y,Z) -
      -12.13           7.75          36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           3
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
      -12.13           9.13          36.00
        1.38          10.00
CONTROL NAME -
        'LGT CONT KNOBS
LOCATION(X,Y,Z) -
      -12.13           5.50          36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           2
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
      -12.13           5.50          36.00
        0.00          10.00
CONTROL NAME -
        'HYD BOOST CIR BK
LOCATION(X,Y,Z) -
```

```
      -12.13        -2.38        36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           2
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
      -12.13        -2.38        36.00
        0.00        10.00
CONTROL NAME -
        'FUEL VALVE HANDLE
LOCATION(X,Y,Z) -
       -8.00        14.00        36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           1
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
       -8.00        14.00        36.00
        0.00        10.00
CONTROL NAME -
        'EMER DOOR REL
LOCATION(X,Y,Z) -
        9.00        18.25        29.50
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           1
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
        9.00        18.25        29.50
        0.00        10.00
CONTROL NAME -
        'CAU TEST/RESET
LOCATION(X,Y,Z) -
       -9.55        18.05        -2.50
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           3
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
       -9.55        18.05        -2.50
        0.00        10.00
CONTROL NAME -
        'FM RADIO
LOCATION(X,Y,Z) -
```

```
      -13.55        17.55        -2.50
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          2
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
      -13.55        17.55        -2.50
        0.00        10.00
CONTROL NAME -
        'ADF RECEIVER
LOCATION(X,Y,Z) -
      -13.55        22.05        -2.50
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          2
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
      -13.55        22.05        -2.50
        0.00        10.00
CONTROL NAME -
        $
MIN HEAD CLEARANCE -
       0.00
HELMET THICKNESS -
       0.00
HEAD CLEARANCE COORDINATES(X,Y,Z) -
        0.00         0.00         0.00

CREW FUNCTIONS(1-INPUT,2-PRINT,3-EDIT,4-SAVE,5-END)--
  2
PRINT MODE(1-DESC,2-ANCHOR,3-DFP,4-SEAT,5-CONTROL,6-HEAD,7-HAC,8-ALL,9-END)--
          8

CREW STATION DESCRIPTION -          'OH-58A COCKPIT-PILOT'

ANCHORAGE -                         SEAT

DESIGN EYE POINT:
DEP(X,Y,Z) -                         0.00      3.90     33.03
DEP IN UP DIRECTION(X,Y,Z) -         0.00      3.90     43.03
DEP IN FORWARD DIRECTION(X,Y,Z) -    0.00     13.90     33.03
LINE OF SIGHT ANGLE -              -13.00

SEAT DATA:
SEAT BACK ANGLE -                    9.00
SEAT PAN ANGLE -                     8.00
HARNESS % -                         50.00
SEAT REF POINT DOWN-BACK(X,Y,Z) -    0.00      0.00      0.00
SEAT UP-BACK(X,Y,Z) -                0.00      0.00      0.00
SEAT DOWN-FORWARD(X,Y,Z) -           0.00      0.00      0.00

CONTROLS:
```

NO	CONTROL NAME	BODY PART	HARN LOCK	GRIP	PRIM NON-P	LOCATION X	Y	Z
1	CYCLIC	RH	UNLK	CLSN	PRIM	0.00	19.50	11.61
						0.00	25.55	10.76
2	COLLECTIVE	LH	UNLK	CLSN	PRIM	-10.80	17.30	0.00
						-10.80	12.47	8.75
3	RT ANTITORQUE PED	RF	----	----	PRIM	4.00	32.65	-6.26
						4.00	42.15	-7.76
4	LFT ANTITORQUE PED	LF	----	----	PRIM	-5.50	32.65	-6.26
						-5.50	42.15	-7.76
5	FUEL BOOST SW	LH	UNLK	EXTF	NON-P	-0.88	30.00	7.13
						-0.88	30.00	7.13
6	PILOT ICS SELECT	LH	UNLK	FTIP	NON-P	-4.13	30.00	6.63
						-4.13	30.00	6.63
7	FORCE TRIM SW	LH	UNLK	EXTF	NON-P	-1.88	30.00	10.13
						-1.88	30.00	10.13
8	HYD BOOST SW	LH	UNLK	FTIP	NON-P	-0.88	30.00	10.13
						-0.88	30.00	10.13
9	ALT SET KNOB	LH	UNLK	FTIP	NON-P	-3.13	30.00	15.13
						-3.13	30.00	15.13
10	UHF RADIO	LH	UNLK	FTIP	NON-P	-13.32	30.00	4.63
						-13.32	30.00	4.63
11	VHF RADIO	LH	UNLK	FTIP	NON-P	-19.88	30.00	11.13
						-19.88	30.00	11.13
12	TRANSPONDER	LH	UNLK	FTIP	NON-P	-19.88	30.00	16.13
						-19.88	30.00	16.13
13	CLOCK	LH	UNLK	EXTF	NON-P	-8.13	30.00	22.13
						-8.13	30.00	22.13
14	INVERTER SW	LH	UNLK	EXTF	NON-P	-10.25	11.50	36.00
						-10.25	11.50	36.00
15	BAT/GEN SWS	LH	UNLK	EXTF	NON-P	-12.13	11.50	36.00
						-12.13	11.50	36.00
16	ROW 2 SW, OVRHD	LH	UNLK	EXTF	NON-P	-12.13	9.13	36.00
						-12.13	9.13	36.00
17	ROW 3 SW,OVRHD	LH	UNLK	EXTF	NON-P	-12.13	7.75	36.00
						-12.13	9.13	36.00
18	LGT CONT KNOBS	LH	UNLK	FTIP	NON-P	-12.13	5.50	36.00
						-12.13	5.50	36.00
19	HYD BOOST CIR BK	LH	UNLK	FTIP	NON-P	-12.13	-2.38	36.00
						-12.13	-2.38	36.00
20	FUEL VALVE HANDLE	LH	UNLK	CLSN	NON-P	-8.00	14.00	36.00
						-8.00	14.00	36.00
21	EMER DOOR REL	RH	UNLK	CLSN	NON-P	9.00	18.25	29.50
						9.00	18.25	29.50
22	CAU TEST/RESET	LH	UNLK	EXTF	NON-P	-9.55	18.05	-2.50
						-9.55	18.05	-2.50
23	FM RADIO	LH	UNLK	FTIP	NON-P	-13.55	17.55	-2.50
						-13.55	17.55	-2.50
24	ADF RECEIVER	LH	UNLK	FTIP	NON-P	-13.55	22.05	-2.50
						-13.55	22.05	-2.50

HEAD CLEARANCE:
MIN HEAD CLEARANCE - 0.00
HELMET THICKNESS - 0.00
HEAD CLEARANCE COORDINATES(X,Y,Z) - 0.00 0.00 0.00

```
CREW FUNCTIONS(1-INPUT,2-PRINT,3-EDIT,4-SAVE,5-END)--
  4
ENTER FILENAME FOR CREWSTATION ANALYSIS     --
        'OH5AA'
***CREWSTATION DATA IS SAVED ON FILE:

CREW FUNCTIONS(1-INPUT,2-PRINT,3-EDIT,4-SAVE,5-END)--
  5
CAR(1-OPER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--
        5

END OF CAR MODEL
```

APPENDIX C

OH-58A COCKPIT-COPILOT

```
CREWSTATION ASSESSMENT OF REACH (CAR) MODEL

CAR(1-OPER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--
          2

CREW FUNCTIONS(1-INPUT,2-PRINT,3-EDIT,4-SAVE,5-END)--
  1
INPUT MODE(1=INTERACTIVE;2=FILE)--
          1
CREW STATION DESCRIPTION -
          'OH-58A COCKPIT-COPILOT'
ANCHORAGE(1-DEP,2-SEAT,3-FOOT SEATED,4-FOOT STAND,
  5-HIP,6-SHOULDER-SEATED,7-SHOULDER-STAND)?--
  2
DESIGN EYE POINT:
DEP(X,Y,Z) -
     0.00      3.90     33.03
DEP IN UP DIRECTION(X,Y,Z) -
     0.00      3.90     43.03
DEP IN FORWARD DIRECTION(X,Y,Z) -
     0.00     13.90     33.03
LINE OF SIGHT ANGLE -
    -13.00
SEAT BACK ANGLE -
       9.00
SEAT PAN ANGLE -
       8.00
HARNESS % -
      50.00
SEAT REF POINT DOWN-BACK(X,Y,Z)-
        0.00          0.00          0.00
CONTROL NAME -
          CYCLIC
LOCATION(X,Y,Z) -
        0.00         19.50         11.61
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          1
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          1
ADJUSTABLE LOCATION (X,Y,Z)--
        0.00         25.55         10.76
        6.11         10.00
CONTROL NAME -
          COLLECTIVE
LOCATION(X,Y,Z) -
      -10.80         17.30          0.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          1
HARNESS(1-LOCK,2-UNLOCK)--
          2
```

```
PRIMARY(1-YES,2-NO)--
        1
ADJUSTABLE LOCATION (X,Y,Z)--
      -10.80        12.47          8.75
        9.99        10.00
CONTROL NAME -
        'RT ANTITORQUE PED
LOCATION(X,Y,Z) -
        4.00        32.65         -6.26
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
        5
PRIMARY(1-YES,2-NO)--
        1
ADJUSTABLE LOCATION (X,Y,Z)--
        4.00        42.15         -7.76
        9.62        10.00
CONTROL NAME -
        'LFT ANTITORQUE PED
LOCATION(X,Y,Z) -
       -5.50        32.65         -6.26
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
        4
PRIMARY(1-YES,2-NO)--
        1
ADJUSTABLE LOCATION (X,Y,Z)--
       -5.50        42.15         -7.76
        9.62        10.00
CONTROL NAME -
        'FUEL BOOST SW
LOCATION(X,Y,Z) -
       19.48        30.00          7.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
        1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
        3
HARNESS(1-LOCK,2-UNLOCK)--
        2
PRIMARY(1-YES,2-NO)--
        2
ADJUSTABLE LOCATION (X,Y,Z)--
       19.48        30.00          7.13
        0.00        10.00
CONTROL NAME -
       'COPILOT ICS SELECT
LOCATION(X,Y,Z) -
       -2.77        30.00          6.63
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
        1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
        2
HARNESS(1-LOCK,2-UNLOCK)--
        2
PRIMARY(1-YES,2-NO)--
        2
ADJUSTABLE LOCATION (X,Y,Z)--
       -2.77        30.00          6.63
        0.00        10.00
CONTROL NAME -
        'FORCE TRIM SW
LOCATION(X,Y,Z) -
```

```
       18.48          30.00          10.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          3
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
       18.48          30.00          10.13
        0.00          10.00
CONTROL NAME -
        'HYD BOOST SW
LOCATION(X,Y,Z) -
       19.48          30.00          10.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          2
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
       19.48          30.00          10.13
        0.00          10.00
CONTROL NAME -
        'ALT SET KNOB
LOCATION(X,Y,Z) -
       17.23          30.00          15.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          2
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
       17.23          30.00          15.13
        0.00          10.00
CONTROL NAME -
        'UHF RADIO
LOCATION(X,Y,Z) -
        7.04          30.00           4.63
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          2
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
        7.04          30.00           4.63
        0.00          10.00
CONTROL NAME -
        'VHF RADIO
LOCATION(X,Y,Z) -
```

```
        0.48          30.00          11.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          2
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
        0.48          30.00          11.13
        0.00          10.00
CONTROL NAME -
         TPANSPONDER
LOCATION(X,Y,Z) -
        0.48          30.00          16.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          2
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
        0.48          30.00          16.13
        0.00          10.00
CONTROL NAME -
         'CLOCK
          ,Y,Z) -
         .23          30.00          22.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          3
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
       12.23          30.00          22.13
        0.00          10.00
CONTROL NAME -
         'INVERTER SW
LOCATION(X,Y,Z) -
       10.11          11.50          36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          3
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
       10.11          11.50          36.00
        0.00          10.00
CONTROL NAME -
         'BAT/GEN SWS
LOCATION(X,Y,Z) -
```

```
        8.23        11.50        36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
        1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
        3
HARNESS(1-LOCK,2-UNLOCK)--
        2
PRIMARY(1-YES,2-NO)--
        2
ADJUSTABLE LOCATION (X,Y,Z)--
        8.23        11.50        36.00
        0.00        10.00
CONTROL NAME -
        'ROW 2 SW, OVRHD
LOCATION(X,Y,Z) -
        8.23         9.13        36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
        1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
        3
HARNESS(1-LOCK,2-UNLOCK)--
        2
PRIMARY(1-YES,2-NO)--
        2
ADJUSTABLE LOCATION (X,Y,Z)--
        8.23         9.13        36.00
        0.00        10.00
CONTROL NAME -
        'ROW 3 SW,OVRHD
LOCATION(X,Y,Z) -
        8.23         7.75        36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
        1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
        3
HARNESS(1-LOCK,2-UNLOCK)--
        2
PRIMARY(1-YES,2-NO)--
        2
ADJUSTABLE LOCATION (X,Y,Z)--
        8.23         9.13        36.00
        1.38        10.00
CONTROL NAME -
        'LGT CONT KNOBS
LOCATION(X,Y,Z) -
        8.23         5.50        36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
        1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
        2
HARNESS(1-LOCK,2-UNLOCK)--
        2
PRIMARY(1-YES,2-NO)--
        2
ADJUSTABLE LOCATION (X,Y,Z)--
        8.23         5.50        36.00
        0.00        10.00
CONTROL NAME -
        'HYD BOOST CIR BK
LOCATION(X,Y,Z) -
```

```
        8.23        -2.38        36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           2
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
        8.23        -2.38        36.00
        0.00        10.00
CONTROL NAME -
        'FUEL VALVE HANDLE
LOCATION(X,Y,Z) -
       12.36        14.00        36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           1
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
       12.36        14.00        36.00
        0.00        10.00
CONTROL NAME -
        'EMER DOOR REL
LOCATION(X,Y,Z) -
       -9.00        18.25        29.50
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           1
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
       -9.00        18.25        29.50
        0.00        10.00
CONTROL NAME -
        'CAU TEST/RESET
LOCATION(X,Y,Z) -
       10.81        18.05        -2.50
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           3
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
       10.81        18.05        -2.50
        0.00        10.00
CONTROL NAME -
        'FM RADIO
LOCATION(X,Y,Z) -
```

```
        6.81        17.55        -2.50
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          2
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
        6.81        17.55        -2.50
        0.00        10.00
CONTROL NAME -
        'ADF RECEIVER
LOCATION(X,Y,Z) -
        6.81        22.05        -2.50
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          2
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
        6.81        22.05        -2.50
        0.00        10.00
CONTROL NAME -
        $
MIN HEAD CLEARANCE -
       0.00
HELMET THICKNESS -
       0.00
HEAD CLEARANCE COORDINATES(X,Y,Z) -
        0.00         0.00         0.00

CREW FUNCTIONS(1-INPUT,2-PRINT,3-EDIT,4-SAVE,5-END)--
  2
PRINT MODE(1-DESC,2-ANCHOR,3-DEP,4-SEAT,5-CONTROL,6-HEAD,7-HAC,8-ALL,9-END)--
          8

CREW STATION DESCRIPTION -          'OH-58A COCKPIT-COPILOT'

ANCHORAGE -                         SEAT

DESIGN EYE POINT:
DEP(X,Y,Z) -                         0.00      3.90     33.03
DEP IN UP DIRECTION(X,Y,Z) -         0.00      3.90     43.03
DEP IN FORWARD DIRECTION(X,Y,Z) -    0.00     13.90     33.03
LINE OF SIGHT ANGLE -              -13.00

SEAT DATA:
SEAT BACK ANGLE -                    9.00
SEAT PAN ANGLE -                     8.00
HARNESS % -                         50.00
SEAT REF POINT DOWN-BACK(X,Y,Z) -    0.00      0.00      0.00
SEAT UP-BACK(X,Y,Z) -                0.00      0.00      0.00
SEAT DOWN-FORWARD(X,Y,Z) -           0.00      0.00      0.00

CONTROL3:
```

NO	CONTROL NAME	BODY PART	HARN LOCK	GRIP	PRIM NON-P	LOCATION X	Y	Z
1	CYCLIC	RH	UNLK	CLEN	PRIM	0.00	19.50	11.61
						0.00	25.55	10.76
2	COLLECTIVE	LH	UNLK	CLEN	PRIM	-10.80	17.30	0.00
						-10.80	12.47	8.75
3	RT ANTITORQUE PED	RF	----	----	PRIM	4.00	32.65	-6.26
						4.00	42.15	-7.76
4	LFT ANTITORQUE PED	LF	----	----	PRIM	-5.50	32.65	-6.26
						-5.50	42.15	-7.76
5	FUEL BOOST SW	LH	UNLK	EXTP	NON-P	19.48	30.00	7.13
						19.48	30.00	7.13
6	COPILOT ICS SELECT	LH	UNLK	FTIP	NON-P	-2.77	30.00	6.63
						-2.77	30.00	6.63
7	FORCE TRIM SW	LH	UNLK	EXTP	NON-P	18.48	30.00	10.13
						18.48	30.00	10.13
8	HYD BOOST SW	LH	UNLK	FTIP	NON-P	19.48	30.00	10.13
						19.48	30.00	10.13
9	ALT SET KNOB	LH	UNLK	FTIP	NON-P	17.23	30.00	15.13
						17.23	30.00	15.13
10	UHF RADIO	LH	UNLK	FTIP	NON-P	7.04	30.00	4.63
						7.04	30.00	4.63
11	VHF RADIO	LH	UNLK	FTIP	NON-P	0.48	30.00	11.13
						0.48	30.00	11.13
12	TRANSPONDER	LH	UNLK	FTIP	NON-P	0.48	30.00	16.13
						0.48	30.00	16.13
13	CLOCK	LH	UNLK	EXTP	NON-P	12.23	30.00	22.13
						12.23	30.00	22.13
14	INVERTER SW	LH	UNLK	EXTP	NON-P	10.11	11.50	36.00
						10.11	11.50	36.00
15	BAT/GEN SWS	LH	UNLK	EXTP	NON-P	6.23	11.50	36.00
						8.23	11.50	36.00
16	ROW 2 SW, OVRHD	LH	UNLK	EXTP	NON-P	8.23	9.13	36.00
						8.23	9.13	36.00
17	ROW 3 SW,OVRHD	LH	UNLK	EXTP	NON-P	8.23	7.75	36.00
						8.23	9.13	36.00
18	LGT CONT KNOBS	LH	UNLK	FTIP	NON-P	8.23	5.50	36.00
						8.23	5.50	36.00
19	HYD BOOST CIR BK	LH	UNLK	FTIP	NON-P	8.23	-2.38	36.00
						8.23	-2.38	36.00
20	FUEL VALVE HANDLE	LH	UNLK	CLEN	NON-P	12.36	14.00	36.00
						12.36	14.00	36.00
21	EMER DOOR REL	LH	UNLK	CLEN	NON-P	-9.00	18.25	29.50
						-9.00	18.25	29.50
22	CAU TEST/RESET	LH	UNLK	EXTP	NON-P	10.81	18.05	-2.50
						10.81	18.05	-2.50
23	FM RADIO	LH	UNLK	FTIP	NON-P	6.81	17.55	-2.50
						6.81	17.55	-2.50
24	ADF RECEIVER	LH	UNLK	FTIP	NON-P	6.81	22.05	-2.50
						6.81	22.05	-2.50

HEAD CLEARANCE:

MIN HEAD CLEARANCE -	0.00		
HELMET THICKNESS -	0.00		
HEAD CLEARANCE COORDINATES(X,Y,Z) -	0.00	0.00	0.00

```
CREW FUNCTIONS(1-INPUT,2-PRINT,3-EDIT,4-SAVE,5-END)--
  4
ENTER FILENAME FOR CREWSTATION ANALYSIS     --
          'OH58A'
***CREWSTATION DATA IS SAVED ON FILE:

CREW FUNCTIONS(1-INPUT,2-PRINT,3-EDIT,4-SAVE,5-END)--
  5
CAR(1-OPER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--
         5

END OF CAR MODEL
```

APPENDIX D

OH-58A COCKPIT-OBSERVER

```
CREWSTATION ASSESSMENT OF REACH (CAR) MODEL

CAR(1-OPER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--
          2

CREW FUNCTIONS(1-INPUT,2-PRINT,3-EDIT,4-SAVE,5-END)--
  1
INPUT MODE(1=INTERACTIVE;2=FILE)--
          1
CREW STATION DESCRIPTION -
          ''OH-58A COCKPIT-OBS'
ANCHORAGE(1-DEP,2-SEAT,3-FOOT SEATED,4-FOOT STAND,
  5-HIP,6-SHOULDER-SEATED,7-SHOULDER-STAND)?--
  2
DESIGN EYE POINT:
DEP(X,Y,Z) -
     0.00      3.90     33.03
DEP IN UP DIRECTION(X,Y,Z) -
     0.00      3.90     43.03
DEP IN FORWARD DIRECTION(X,Y,Z) -
     0.00     13.90     33.03
LINE OF SIGHT ANGLE -
    -13.00
SEAT BACK ANGLE -
       9.00
SEAT PAN ANGLE -
       8.00
HARNESS % -
      50.00
SEAT REF POINT DOWN-BACK(X,Y,Z) -
        0.00         0.00         0.00
CONTROL NAME -
         CYCLIC
LOCATION(X,Y,Z) -
        0.00        19.50        11.61
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          1
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          1
ADJUSTABLE LOCATION (X,Y,Z)--
        0.00        25.55        10.76
        6.11        10.00
CONTROL NAME -
         COLLECTIVE
LOCATION(X,Y,Z) -
      -10.30        17.30         0.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          1
HARNESS(1-LOCK,2-UNLOCK)--
          2
```

```
PRIMARY(1-YES,2-NO)--
          1
ADJUSTABLE LOCATION (X,Y,Z)--
       -10.80         12.47          8.75
         9.99         10.00
CONTROL NAME -
         'RT ANTITORQUE PED
LOCATION(X,Y,Z) -
         4.00         32.65         -6.26
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          5
PRIMARY(1-YES,2-NO)--
          1
ADJUSTABLE LOCATION (X,Y,Z)--
         4.00         42.15         -7.76
         9.62         10.00
CONTROL NAME -
         'LFT ANTITORQUE PED
LOCATION(X,Y,Z) -
        -5.50         32.65         -6.26
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          4
PRIMARY(1-YES,2-NO)--
          1
ADJUSTABLE LOCATION (X,Y,Z)--
        -5.50         42.15         -7.76
         9.62         10.00
CONTROL NAME -
         'FUEL BOOST SW
LOCATION(X,Y,Z) -
        19.48         30.00          7.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          3
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
        19.48         30.00          7.13
         0.00         10.00
CONTROL NAME -
        'COPILOT ICS SELECT
LOCATION(X,Y,Z) -
        -2.77         30.00          6.63
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          2
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
        -2.77         30.00          6.63
         0.00         10.00
CONTROL NAME -
        'FORCE TRIM SW
LOCATION(X,Y,Z) -
```

```
       18.48          30.00          10.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          3
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
       18.48          30.00          10.13
        0.00          10.00
CONTROL NAME -
        'HYD BOOST SW
LOCATION(X,Y,Z) -
       19.48          30.00          10.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          2
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
       19.48          30.00          10.13
        0.00          10.00
CONTROL NAME -
        'ALT SET KNOB
LOCATION(X,Y,Z) -
       17.23          30.00          15.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          2
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
       17.23          30.00          15.13
        0.00          10.00
CONTROL NAME -
        'UHF RADIO
LOCATION(X,Y,Z) -
        7.04          30.00           4.63
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          2
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
        7.04          30.00           4.63
        0.00          10.00
CONTROL NAME -
        'VHF RADIO
LOCATION(X,Y,Z) -
```

```
        0.48          30.00          11.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          2
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
        0.48          30.00          11.13
        0.00          10.00
CONTROL NAME -
         TRANSPONDER
LOCATION(X,Y,Z) -
        0.48          30.00          16.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          2
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
        0.48          30.00          16.13
        0.00          10.00
CONTROL NAME -
        'CLOCK
LOCATION(X,Y,Z) -
       12.23          30.00          22.13
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          3
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
       12.23          30.00          22.13
        0.00          10.00
CONTROL NAME -
        'INVERTER SW
LOCATION(X,Y,Z) -
       10.11          11.50          36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          3
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
       10.11          11.50          36.00
        0.00          10.00
CONTROL NAME -
        'BAT/GEN SWS
LOCATION(X,Y,Z) -
```

```
        8.23        11.50        36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          3
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
        8.23        11.50        36.00
        0.00        10.00
CONTROL NAME -
        'ROW 2 SW, OVRHD
LOCATION(X,Y,Z) -
        8.23         9.13        36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          3
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
        8.23         9.13        36.00
        0.00        10.00
CONTROL NAME -
        'ROW 3 SW,OVRHD
LOCATION(X,Y,Z) -
        8.23         7.75        36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          3
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
        8.23         9.13        36.00
        1.38        10.00
CONTROL NAME -
        'LGT CONT KNOBS
LOCATION(X,Y,Z) -
        8.23         5.50        36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
          2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
          2
HARNESS(1-LOCK,2-UNLOCK)--
          2
PRIMARY(1-YES,2-NO)--
          2
ADJUSTABLE LOCATION (X,Y,Z)--
        8.23         5.50        36.00
        0.00        10.00
CONTROL NAME -
        'HYD BOOST CIR BK
LOCATION(X,Y,Z) -
```

```
        8.23          -2.38          36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           2
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
        8.23          -2.38          36.00
        0.00          10.00
CONTROL NAME -
        'FUEL VALVE HANDLE
LOCATION(X,Y,Z) -
       12.36          14.00          36.00
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           1
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
       12.36          14.00          36.00
        0.00          10.00
CONTROL NAME -
        'EMER DOOR REL
LOCATION(X,Y,Z) -
       -9.00          18.25          29.50
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
           1
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
           1
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
A   ISTABLE LOCATION (X,Y,Z)--
       -9.00          18.25          29.50
        0.00          10.00
CONTROL NAME -
        'CAU TEST/RESET
LOCATION(X,Y Z) -
       10.8           18.05          -2.50
BODY PART(1-.   '-RH,3-BH,4-LF,5-RF,6-BF)--
           2
     1-CLENCHE)     'NGER TIP,3-EXTENDED)--
           3
HARNESS(1-LOCK,2-UNLOCK)--
           2
PRIMARY(1-YES,2-NO)--
           2
ADJUSTABLE LOCATION (X,Y,Z)--
       10.81          18.05          -2.50
        0.00          10.00
CONTROL NAME -
        'FM RADIO
LOCATION(X,Y,Z) -
```

```
        6.81        17.55        -2.50
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
        2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
        2
HARNESS(1-LOCK,2-UNLOCK)--
        2
PRIMARY(1-YES,2-NO)--
        2
ADJUSTABLE LOCATION (X,Y,Z)--
        6.81        17.55        -2.50
        0.00        10.00
CONTROL NAME -
        'ADF RECEIVER
LOCATION(X,Y,Z) -
        6.81        22.05        -2.50
BODY PART(1-LH,2-RH,3-BH,4-LF,5-RF,6-BF)--
        2
GRIP(1-CLENCHED,2-FINGER TIP,3-EXTENDED)--
        2
HARNESS(1-LOCK,2-UNLOCK)--
        2
PRIMARY(1-YES,2-NO)--
        2
ADJUSTABLE LOCATION (X,Y,Z)--
        6.81        22.05        -2.50
        0.00        10.00
CONTROL NAME -
        $
MIN HEAD CLEARANCE -
        0.00
HELMET THICKNESS -
        0.00
HEAD CLEARANCE COORDINATES(X,Y,Z) -
        0.00         0.00         0.00

CREW FUNCTIONS(1-INPUT,2-PRINT,3-EDIT,4-SAVE,5-END)--
  2
PRINT MODE(1-DESC,2-ANCHOR,3-DEP,4-SEAT,5-CONTROL,6-HEAD,7-HAC,8-ALL,9-END)--
        8

CREW STATION DESCRIPTION -          'OH-58A COCKPIT-OBS'

ANCHORAGE -                         SEAT

DESIGN EYE POINT:
DEP(X,Y,Z) -                          0.00      3.90     33.03
DEP IN UP DIRECTION(X,Y,Z) -          0.00      3.90     43.03
DEP IN FORWARD DIRECTION(X,Y,Z) -     0.00     13.90     33.03
LINE OF SIGHT ANGLE -               -13.00

SEAT DATA:
SEAT BACK ANGLE -                     9.00
SEAT PAN ANGLE -                      8.00
HARNESS % -                          50.00
SEAT REF POINT DOWN-BACK(X,Y,Z) -     0.00      0.00      0.00
SEAT UP-BACK(X,Y,Z) -                 0.00      0.00      0.00
SEAT DOWN-FORWARD(X,Y,Z) -            0.00      0.00      0.00

CONTROLS:
```

NO	CONTROL NAME	BODY PART	HARN LOCK	GRIP	PRIM NON-P	LOCATION X	Y	Z
1	CYCLIC	RH	UNLK	CLEN	PRIM	0.00	19.50	11.61
						0.00	25.55	10.76
2	COLLECTIVE	LH	UNLK	CLEN	PRIM	-10.80	17.30	0.00
						-10.80	12.47	8.75
3	RT ANTITORQUE PED	RF	----	----	PRIM	4.00	32.65	-6.26
						4.00	42.15	-7.76
4	LFT ANTITORQUE PED	LF	----	----	PRIM	-5.50	32.65	-6.26
						-5.50	42.15	-7.76
5	FUEL BOOST SW	RH	UNLK	EXTF	NON-P	19.48	30.00	7.13
						19.48	30.00	7.13
6	COPILOT ICS SELECT	LH	UNLK	FTIP	NON-P	-2.77	30.00	6.63
						-2.77	30.00	6.63
7	FORCE TRIM SW	RH	UNLK	EXTF	NON-P	18.48	30.00	10.13
						18.48	30.00	10.13
8	HYD BOOST SW	RH	UNLK	FTIP	NON-P	19.48	30.00	10.13
						19.48	30.00	10.13
9	ALT SET KNOB	RH	UNLK	FTIP	NON-P	17.23	30.00	15.13
						17.23	30.00	15.13
10	UHF RADIO	RH	UNLK	FTIP	NON-P	7.04	30.00	4.63
						7.04	30.00	4.63
11	VHF RADIO	RH	UNLK	FTIP	NON-P	0.48	30.00	11.13
						0.48	30.00	11.13
12	TRANSPONDER	RH	UNLK	FTIP	NON-P	0.48	30.00	16.13
						0.48	30.00	16.13
13	CLOCK	RH	UNLK	EXTF	NON-P	12.23	30.00	22.13
						12.23	30.00	22.13
14	INVERTER SW	RH	UNLK	EXTF	NON-P	10.11	11.50	36.00
						10.11	11.50	36.00
15	BAT/GEN SWS	RH	UNLK	EXTF	NON-P	8.23	11.50	36.00
						8.23	11.50	36.00
16	ROW 2 SW, OVRHD	RH	UNLK	EXTF	NON-P	8.23	9.13	36.00
						8.23	9.13	36.00
17	ROW 3 SW,OVRHD	RH	UNLK	FXTF	NON-P	8.23	7.75	36.00
						8.23	9.13	36.00
18	LGT CONT KNOBS	RH	UNLK	FTIP	NON-P	8.23	5.50	36.00
						8.23	5.50	36.00
19	HYD BOOST CIR BK	RH	UNLK	FTIP	NON-P	8.23	-2.38	36.00
						8.23	-2.38	36.00
20	FUEL VALVE HANDLE	RH	UNLK	CLEN	NON-P	12.36	14.00	36.00
						12.36	14.00	36.00
21	EMER DOOR REL	LH	UNLK	CLEN	NON-P	-9.00	18.25	29.50
						-9.00	18.25	29.50
22	CAU TEST/RESET	RH	UNLK	EXTF	NON-P	10.81	18.05	-2.50
						10.81	18.05	-2.50
23	FM RADIO	RH	UNLK	FTIP	NON-P	6.81	17.55	-2.50
						6.81	17.55	-2.50
24	ADF RECEIVER	RH	UNLK	FTIP	NON-P	6.81	22.05	-2.50
						6.81	22.05	-2.50

HEAD CLEARANCE:
MIN HEAD CLEARANCE - 0.00
HELMET THICKNESS - 0.00
HEAD CLEARANCE COORDINATES(X,Y,Z) - 0.00 0.00 0.00

```
CREW FUNCTIONS (1-INPUT, 2-PRINT, 3-EDIT, 4-SAVE, 5-END) --
  4
ENTER FILENAME FOR CREWSTATION ANALYSIS     --
          'OH58A'
***CREWSTATION DATA IS SAVED ON FILE:

CREW FUNCTIONS (1-INPUT, 2-PRINT, 3-EDIT, 4-SAVE, 5-END) --
  5
CAR (1-OPER SAMPLE, 2-CREWSTATION, 3-ACCOM ANALYSIS, 4-REACH ENV, 5-END) --
          5

END OF CAR MODEL
```

APPENDIX E

MEANS, STANDARD DEVIATIONS AND CORRELATION MATRIX

```
CREWSTATION ASSESSMENT OF REACH (CAR) MODEL

CAR(1-OPER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--
         1
OPER SAMPLE OPT(1-GENERATE SAMPLE,2-ACTUAL OPER MEAS,3-END)
         1
 GENERATE FUNCTIONS(1-INPUT;2-EDIT;3-SAVE;4-PRINT;5-GENERATE;6-END)--
         1
INPUT MODE(1=INTERACTIVE;2=FILE)--
         2


DIAGNOSTICS OF FORMATTED READ

CORRELATION/ANTHROPOMETRIC MEASUREMENTS:
***TOTAL ERRORS ON INPUT DATA      0
 GENERATE FUNCTIONS(1-INPUT;2-EDIT;3-SAVE;4-PRINT;5-GENERATE;6-END)--
         4
PRINT MODE(1-MEAN/STD;2-COR MATRX;3-OPER MEAS;4-LINK LENG;5-END)--
  1

 'ARMY AVIATORS'

          MEANS AND STANDARD DEVIATIONS(IN INCHES)
-------------------------------------------------------------------
        MEASUREMENT                          MEANS      STD DEV
-------------------------------------------------------------------
  1-STATURE                                  68.72        2.49
  2-WAIST HEIGHT                             41.75        1.99
  3-SITTING HEIGHT                           35.80        1.27
  4-EYE HEIGHT-SITTING                       31.02        1.25
  5-POPLITEAL HEIGHT-SITTING                 16.67        0.97
  6-BUTTOCK-KNEE LENGTH                      23.70        1.04
  7-SHOULDER-ELBOW LENGTH                    14.45        0.70
  8-FOREARM-HAND LENGTH                      18.95        0.83
  9-BIDELTOID DIAMETER                       18.66        1.01
 10-HIP BREADTH                              13.83        0.84
 11-FOOT LENGTH                              10.43        0.50
 12-HAND LENGTH                               7.56        0.34
-------------------------------------------------------------------

PRINT MODE(1-MEAN/STD;2-COR MATRX;3-OPER MEAS;4-LINK LENG;5-END)--
  2

 'ARMY AVIATORS'

                        CORRELATION MATRIX
-------------------------------------------------------------------
STAT  WAIS  SIT   EYE   POT   BUTT  S HOU  FORE  BIDE  HIP   FOOT  HAND
-------------------------------------------------------------------
  1     2     3     4     5     6     7     8     9     10    11    12
-------------------------------------------------------------------
1.000 0.905 0.760 0.734 0.774 0.774 0.676 0.762 0.327 0.411 0.661 0.600
      1.000 0.547 0.533 0.813 0.781 0.669 0.761 0.271 0.315 0.615 0.570
            1.000 0.924 0.443 0.382 0.414 0.472 0.257 0.332 0.468 0.428
```

```
1.000 0.402 0.392 0.428 0.438 0.287 0.353 0.424 0.399
      1.000 0.620 0.588 0.740 0.144 0.182 0.545 0.546
            1.000 0.676 0.664 0.444 0.529 0.543 0.503
                  1.000 0.671 0.313 0.305 0.470 0.592
                        1.000 0.280 0.340 0.712 0.775
                              1.000 0.510 0.220 0.253
                                    1.000 0.365 0.268
                                          1.000 0.659
                                                1.000
-------------------------------------------------------------------------

PRINT MODE(1-MEAN/STD;2-COR MATRX;3-OPER MEAS;4-LINK LENG;5-END)--
  5
 GENERATE FUNCTIONS(1-INPUT;2-EDIT;3-SAVE;4-PRINT;5-GENERATE;6-END)--
          6
OPER SAMPLE OPT(1-GENERATE SAMPLE,2-ACTUAL OPER MEAS,3-END)
          3
END OF OPERATOR SAMPLE
CAR(1-OPER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--
          5

END OF CAR MODEL
```

APPENDIX F

CREWSTATION ANALYSIS-PILOT

```
CREWSTATION ASSESSMENT OF REACH (CAR) MODEL

CAR(1-OPER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--
        3
  INDICATE WHICH CONTROLS ARE TO BE ANALYZED(0=ALL;N,M=RANGE)--
  1  24
  SAMPLE SIZE(0=ALL;N,M=RANGE)--
  1  50
  DISPLAY OPERATOR IDS FOR REACH FAILURE(0-NO,1-YES)--
  0
  RESTRICT SAMPLE BASED UPON MEAS PERCENTILES (0-NO,1-YES)---
  1
  ENTER LOWER AND UPPER PERCENTILE VALUES--
  5  95
  CLOTHING(1-NONE;2-SUMMER;3-WINTER)--
  2
  ANALYSIS OPTION(1-ALL OPERATORS,2-OPERATORS ON LOS ONLY)--
  1
  REACH ALGORITHM(1=PASS THROUGH CONTROL,2-TERMINATE AT CONTROL)--
  2
***OPERATOR NO:    1 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      2
***OPERATOR NO:    5 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      5
***OPERATOR NO:    6 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      7
***OPERATOR NO:    7 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      2
***OPERATOR NO:   11 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      8
***OPERATOR NO:   12 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   13 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      2
***OPERATOR NO:   14 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   15 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      4
***OPERATOR NO:   22 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   24 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   28 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   30 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     10
***OPERATOR NO:   34 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      5
***OPERATOR NO:   36 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      5
***OPERATOR NO:   37 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      7
***OPERATOR NO:   39 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     11
***OPERATOR NO:   40 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      2
***OPERATOR NO:   43 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   44 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   46 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      5

                    -------------------------------
                    CREWSTATION ASSESSMENT OF REACH
                    -------------------------------

SAMPLE:             ARMY AVIA TORS                          FILE:
OPERATOR NOS:         1- 50
MEASUREMENT:        STATURE                                 PERCENTILE:  5- 95
NO OPER ANALYZED:   29
CLOTHING:           SUMMER

CREWSTATION:        OH-58A COC KPIT-PILOT                   FILE:        MEAS/ST
ANCHORAGE:          SEAT
```

DEP:	0.00	3.90	33.03	LOS ANGLE:	-13.0
SEAT BACK:	9.00			SEAT PAN:	8.0
TRACKS:	LEFT	RIGHT		HARNESS:	50.%
DOWN BACK:	0.00	0.00	0.00		

REACH ALGORITHM: TERMINATE AT CONTROL

VISION ACCOMMODATION

	LINE OF SIGHT ABOVE		ON		BELOW	
	%	DIST	%	DIST	%	DIST
FORWARD OF DEP	0.00	0.00	0.00	0.00	79.31	2.13
BEHIND DEP	0.00	0.00	0.00	0.00	20.69	0.32

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM DEP

VERTICAL	HORIZONTAL
-1.74	0.19

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM SEAT DB

VERTICAL	HORIZONTAL
0.00	0.00

PERCENTAGE OF CREWPEOPLE ACCOMMODATED

POSITION TO VISION POINT 0.00 .

	ALL CONTROLS ZONE1&3	ALL CONTROLS ZONE2&3	PRIMARY ONLY ZONE1&3	PRIMARY ONLY ZONE2&3
REACH CONTROLS	0.00	0.00	0.00	0.00
VISION POINT&REACH CONTROLS	0.00	0.00	0.00	0.00

CONTROL SUMMARY

NO	CONTROL NAME	%	HAND FOOT	HARN LOCK	GRIP	LOCATION/ REQUIRED MOVEMENT X	Y	Z
1	*CYCLIC		RH	UNLK	CLEN	0.0	19.5	11.0
	ZONE3 ACCOMODATED	100						
2	*COLLECTIVE		LH	UNLK	CLEN	-10.8	17.3	0.0
	ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION						-10.8	12.5	8.8
	ZONE3 ACCOMODATED	100						

BOTH ENDS

ZONE3 ACCOMODATED	100						
3*RT ANTITORQUE PED		RF		4.0	32.6	-6.3	
ZONE3 ACCOMODATED	34						
ANG LIMITS	65						
ADJUSTABLE LOCATION			4.0	42.1	-7.8		
ZONE3 ACCOMODATED	0						
TOO FAR	100	AVERAGE		-1.4	-2.9	0.0	3.2
		WORSE CASE		-2.2	-4.6	-0.1	5.1
BOTH ENDS							
ZONE3 ACCOMODATED	0						
TOO FAR	100						
4*LFT ANTITORQUE PED		LF		-5.5	32.6	-6.3	
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION			-5.5	42.1	-7.8		
ZONE3 ACCOMODATED	0						
TOO FAR	100	AVERAGE		1.1	-2.4	-0.1	2.7
		WORSE CASE		1.9	-4.1	-0.2	4.6
BOTH ENDS							
ZONE3 ACCOMODATED	0						
TOO FAR	100						
5 FUEL BOOST SW		LH UNLK EXTF		-0.9	30.0	7.1	
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION			-0.9	30.0	7.1		
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
6 PILOT ICS SELECT		LH UNLK FTIP		-4.1	30.0	6.6	
ZONE3 ACCOMODATED	89						
TOO FAR	10	AVERAGE		0.0	-0.2	0.1	0.2
		WORSE CASE		0.0	-0.3	0.2	0.3
ADJUSTABLE LOCATION			-4.1	30.0	6.6		
ZONE3 ACCOMODATED	89						
TOO FAR	10	AVERAGE		0.0	-0.2	0.1	0.2
		WORSE CASE		0.0	-0.3	0.2	0.3
BOTH ENDS							
ZONE3 ACCOMODATED	89						
TOO FAR	10						
7 FORCE TRIM SW		LH UNLK EXTF		-1.9	30.0	10.1	
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION			-1.9	30.0	10.1		
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
8 HYD BOOST SW		LH UNLK FTIP		-0.9	30.0	10.1	

ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION			-0.9	30.0	10.1		
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
9 ALT SET KNOB		LH	UNLK FTIP	-3.1	30.0	15.1	
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION			-3.1	30.0	15.1		
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
10 UHF RADIO		LH	UNLK FTIP	-13.3	30.0	4.6	
ZONE3 ACCOMODATED	75						
TOO FAR	24	AVERAGE		0.1	-0.4	0.3	0.5
		WORSE CASE		0.1	-0.6	0.5	0.8
ADJUSTABLE LOCATION			-13.3	30.0	4.6		
ZONE3 ACCOMODATED	75						
TOO FAR	24	AVERAGE		0.1	-0.4	0.3	0.5
		WORSE CASE		0.1	-0.6	0.5	0.8
BOTH ENDS							
ZONE3 ACCOMODATED	75						
TOO FAR	24						
11 VHF RADIO		LH	UNLK FTIP	-19.9	30.0	11.1	
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION			-19.9	30.0	11.1		
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
12 TRANSPONDER		LH	UNLK FTIP	-19.9	30.0	16.1	
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION			-19.9	30.0	16.1		
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
13 CLOCK		LH	UNLK EXTF	-8.1	30.0	22.1	
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION			-8.1	30.0	22.1		
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
14 INVERTER SW		LH	UNLK EXTF	-10.3	11.5	36.0	
ZONE3 ACCOMODATED	100						

ADJUSTABLE LOCATION				-10.3	11.5	36.0
ZONE3 ACCOMODATED	100					
BOTH ENDS						
ZONE3 ACCOMODATED	100					
15 BAT/GEN SWS		LH	UNLK EXTF	-12.1	11.5	36.0
ZONE3 ACCOMODATED	100					
ADJUSTABLE LOCATION				-12.1	11.5	36.0
ZONE3 ACCOMODATED	100					
BOTH ENDS						
ZONE3 ACCOMODATED	100					
16 ROW 2 SW, OVRHD		LH	UNLK EXTF	-12.1	9.1	36.0
ZONE3 ACCOMODATED	89					
ANG LIMITS	10					
ADJUSTABLE LOCATION				-12.1	9.1	36.0
ZONE3 ACCOMODATED	89					
ANG LIMITS	10					
BOTH ENDS						
ZONE3 ACCOMODATED	89					
TOO FAR	10					
17 ROW 3 SW,OVRHD		LH	UNLK EXTF	-12.1	7.8	36.0
ZONE3 ACCOMODATED	65					
ANG LIMITS	34					
ADJUSTABLE LOCATION				-12.1	9.1	36.0
ZONE3 ACCOMODATED	89					
ANG LIMITS	10					
BOTH ENDS						
ZONE3 ACCOMODATED	65					
TOO FAR	34					
18 LGT CONT KNOBS		LH	UNLK FTIP	-12.1	5.5	36.0
ZONE3 ACCOMODATED	93					
ANG LIMITS	6					
ADJUSTABLE LOCATION				-12.1	5.5	36.0
ZONE3 ACCOMODATED	93					
ANG LIMITS	6					
BOTH ENDS						
ZONE3 ACCOMODATED	93					
TOO FAR	6					
19 HYD BOOST CIR BK		LH	UNLK FTIP	-12.1	-2.4	36.0
ZONE3 ACCOMODATED	75					
ANG LIMITS	24					
ADJUSTABLE LOCATION				-12.1	-2.4	36.0
ZONE3 ACCOMODATED	75					
ANG LIMITS	24					

BOTH ENDS							
ZONE3 ACCOMODATED	75						
TOO FAR	24						
20 FUEL VALVE HANDLE		LH	UNLK CLEN	-8.0	14.0	36.0	
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION				-8.0	14.0	36.0	
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
21 EMER DOOR REL		RH	UNLK CLEN	9.0	18.3	29.5	
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION				9.0	18.3	29.5	
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
22 CAU TEST/RESET		LH	UNLK EXTF	-9.6	18.1	-2.5	
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION				-9.6	18.1	-2.5	
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
23 FM RADIO		LH	UNLK FTIP	-13.6	17.6	-2.5	
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION				-13.6	17.6	-2.5	
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
24 ADF RECEIVER		LH	UNLK FTIP	-13.6	22.1	-2.5	
ZONE3 ACCOMODATED	96						
TOO FAR	3	AVERAGE		0.0	0.0	0.0	0.0
		WORSE CASE		0.0	0.0	0.0	0.0
ADJUSTABLE LOCATION				-13.6	22.1	-2.5	
ZONE3 ACCOMODATED	96						
TOO FAR	3	AVERAGE		0.0	0.0	0.0	0.0
		WORSE CASE		0.0	0.0	0.0	0.0
BOTH ENDS							
ZONE3 ACCOMODATED	96						
TOO FAR	3						

CAR(1-OPER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--

5

END OF CAR MODEL

APPENDIX G

CREWSTATION ANALYSIS-COPILOT

```
CREWSTATION ASSESSMENT OF REACH (CAR) MODEL

CAR(1-OPER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--
        3
  INDICATE WHICH CONTROLS ARE TO BE ANALYZED(0=ALL;N,M=RANGE)--
  1  24
  SAMPLE SIZE(0=ALL;N,M=RANGE)--
  1  50
  DISPLAY OPERATOR IDS FOR REACH FAILURE(0-NO,1-YES)--
  0
  RESTRICT SAMPLE BASED UPON MEAS PERCENTILES (0-NO,1-YES)---
  1
  ENTER LOWER AND UPPER PERCENTILE VALUES--
  5  95
  CLOTHING(1-NONE;2-SUMMER;3-WINTER)--
  2
  ANALYSIS OPTION(1-ALL OPERATORS,2-OPERATORS ON LOS ONLY)--
  1
  REACH ALGORITHM(1=PASS THROUGH CONTROL,2-TERMINATE AT CONTROL)--
  2
***OPERATOR NO:   1 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     2
***OPERATOR NO:   5 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     5
***OPERATOR NO:   6 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     7
***OPERATOR NO:   7 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     2
***OPERATOR NO:  11 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     8
***OPERATOR NO:  12 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  13 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     2
***OPERATOR NO:  14 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  15 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     4
***OPERATOR NO:  22 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  24 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  28 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  30 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:    10
***OPERATOR NO:  34 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     5
***OPERATOR NO:  36 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     5
***OPERATOR NO:  37 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     7
***OPERATOR NO:  39 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:    11
***OPERATOR NO:  40 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     2
***OPERATOR NO:  43 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  44 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  46 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     5


                  ------------------------------
                  CREWSTATION ASSESSMENT OF REACH
                  ------------------------------

SAMPLE:             ARMY AVIATORS                          FILE:
OPERATOR NOS:         1- 50
MEASUREMENT:        STATURE                                PERCENTILE:  5- 95
NO OPER ANALYZED:   29
CLOTHING:           SUMMER

CREWSTATION:        OH-58A COC KPIT-COPILOT                FILE:        MEAS/ST
ANCHORAGE:          SEAT
```

DEP:	0.00	3.90	33.03	LOS ANGLE:	-13.0
SEAT BACK:	9.00			SEAT PAN:	8.0
TRACKS:	LEFT	RIGHT		HARNESS:	50.K
DOWN BACK:	0.00	0.00	0.00		

REACH ALGORITHM: TERMINATE AT CONTROL

VISION ACCOMMODATION

	LINE OF SIGHT ABOVE		ON		BELOW	
	%	DIST	%	DIST	%	DIST
FORWARD OF DEP	0.00	0.00	0.00	0.00	79.31	2.13
BEHIND DEP	0.00	0.00	0.00	0.00	20.69	0.32

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM DEP

VERTICAL	HORIZONTAL
-1.74	0.19

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM SEAT DB

VERTICAL	HORIZONTAL
0.00	0.00

PERCENTAGE OF CREWPEOPLE ACCOMMODATED

POSITION TO VISION POINT 0.00

	ALL CONTROLS ZONE163	ALL CONTROLS ZONE263	PRIMARY ONLY ZONE153	PRIMARY ONLY ZONE253
REACH CONTROLS	0.00	0.00	0.00	0.00
VISION POINT&REACH CONTROLS	0.00	0.00	0.00	0.00

CONTROL SUMMARY

NO	CONTROL NAME	%	HAND FOOT	HARN LOCK	GRIP	LOCATION/REQUIRED MOVEMENT X	Y	Z
1	*CYCLIC		RH	UNLK	CLEN	0.0	19.5	11.6
	ZONE3 ACCOMODATED	100						
2	*COLLECTIVE		LH	UNLK	CLEN	-10.8	17.3	0.0
	ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION				-10.8		12.5	8.8	
	ZONE3 ACCOMODATED	100						

BOTH ENDS

ZONE3 ACCOMODATED	100						
3*RT ANTITORQUE PED		RF		4.0	32.6	-6.3	
ZONE3 ACCOMODATED	34						
ANG LIMITS	65						
ADJUSTABLE LOCATION			4.0	42.1	-7.8		
ZONE3 ACCOMODATED	0						
TOO FAR	100	AVERAGE		-1.4	-2.9	0.0	3.2
		WORSE CASE		-2.2	-4.6	-0.1	5.1
BOTH ENDS							
ZONE3 ACCOMODATED	0						
TOO FAR	100						
4*LFT ANTITORQUE PED		LF		-5.5	32.6	-6.3	
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION			-5.5	42.1	-7.8		
ZONE3 ACCOMODATED	0						
TOO FAR	100	AVERAGE		1.1	-2.4	-0.1	2.7
		WORSE CASE		1.9	-4.1	-0.2	4.6
BOTH ENDS							
ZONE3 ACCOMODATED	0						
TOO FAR	100						
5 FUEL BOOST SW		LH UNLK EXTF		19.5	30.0	7.1	
ZONE3 ACCOMODATED	0						
TOO FAR	100	AVERAGE		-3.0	-2.9	2.1	4.7
		WORSE CASE		-3.8	-3.7	2.8	6.0
ADJUSTABLE LOCATION			19.5	30.0	7.1		
ZONE3 ACCOMODATED	0						
TOO FAR	100	AVERAGE		-3.0	-2.9	2.1	4.7
		WORSE CASE		-3.8	-3.7	2.8	6.0
BOTH ENDS							
ZONE3 ACCOMODATED	0						
TOO FAR	100						
6 COPILOT ICS SELECT		LH UNLK FTIF		-2.8	30.0	6.6	
ZONE3 ACCOMODATED	75						
TOO FAR	24	AVERAGE		0.0	-0.3	0.2	0.3
		WORSE CASE		-0.1	-0.5	0.4	0.7
ADJUSTABLE LOCATION			-2.8	30.0	6.6		
ZONE3 ACCOMODATED	75						
TOO FAR	24	AVERAGE		0.0	-0.3	0.2	0.3
		WORSE CASE		-0.1	-0.5	0.4	0.7
BOTH ENDS							
ZONE3 ACCOMODATED	75						
TOO FAR	24						
7 FORCE TRIM SW		LH UNLK EXTF		18.5	30.0	10.1	
ZONE3 ACCOMODATED	0						
TOO FAR	100	AVERAGE		-1.9	-1.9	1.1	2.9
		WORSE CASE		-2.7	-2.6	1.7	4.1

ADJUSTABLE LOCATION				18.5	30.0	10.1	
ZONE3 ACCOMODATED	0						
TOO FAR	100	AVERAGE		-1.9	-1.9	1.1	2.9
		WORSE CASE		-2.7	-2.6	1.7	4.1
BOTH ENDS							
ZONE3 ACCOMODATED	0						
TOO FAR	100						
8 HYD BOOST SW		LH UNLK FTIP		19.5	30.0	10.1	
ZONE3 ACCOMODATED	0						
TOO FAR	100	AVERAGE		-4.0	-3.8	2.3	6.0
		WORSE CASE		-4.7	-4.6	2.9	7.2
ADJUSTABLE LOCATION				19.5	30.0	10.1	
ZONE3 ACCOMODATED	0						
TOO FAR	100	AVERAGE		-4.0	-3.8	2.3	6.0
		WORSE CASE		-4.7	-4.6	2.9	7.2
BOTH ENDS							
ZONE3 ACCOMODATED	0						
TOO FAR	100						
9 ALT SET KNOB		LH UNLK FTIP		17.2	30.0	15.1	
ZONE3 ACCOMODATED	0						
TOO FAR	100	AVERAGE		-2.1	-2.1	0.8	3.1
		WORSE CASE		-2.9	-3.0	1.1	4.4
ADJUSTABLE LOCATION				17.2	30.0	15.1	
ZONE3 ACCOMODATED	0						
TOO FAR	100	AVERAGE		-2.1	-2.1	0.8	3.1
		WORSE CASE		-2.9	-3.0	1.1	4.4
BOTH ENDS							
ZONE3 ACCOMODATED	0						
TOO FAR	100						
10 UHF RADIO		LH UNLK FTIP		7.0	30.0	4.6	
ZONE3 ACCOMODATED	0						
TOO FAR	100	AVERAGE		-1.1	-2.0	1.6	2.8
		WORSE CASE		-1.7	-3.0	2.4	4.2
ADJUSTABLE LOCATION				7.0	30.0	4.6	
ZONE3 ACCOMODATED	0						
TOO FAR	100	AVERAGE		-1.1	-2.0	1.6	2.8
		WORSE CASE		-1.7	-3.0	2.4	4.2
BOTH ENDS							
ZONE3 ACCOMODATED	0						
TOO FAR	100						
11 VHF RADIO		LH UNLK FTIP		0.5	30.0	11.1	
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION				0.5	30.0	11.1	
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						

12 TRANSPONDER		LH	UNLK	FTIP	0.5	30.0	16.1
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION				0.5	30.0	16.1	
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
13 CLOCK		LH	UNLK	EXTF	12.2	30.0	22.1
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION				12.2	30.0	22.1	
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
14 INVERTER SW		LH	UNLK	EXTF	10.1	11.5	35.0
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION				10.1	11.5	36.0	
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
15 BAT/GEN SWS		LH	UNLK	EXTF	8.2	11.5	35.0
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION				8.2	11.5	36.0	
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
16 ROW 2 SW, OVRHD		LH	UNLK	EXTF	8.2	9.1	36.0
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION				8.2	9.1	36.0	
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
17 ROW 3 SW,OVRHD		LH	UNLK	EXTF	8.2	7.8	36.0
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION				8.2	9.1	36.0	
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
18 LGT CONT KNOBS		LH	UNLK	FTIP	8.2	5.5	36.0
ZONE3 ACCOMODATED	96						
ANG LIMITS	3						
ADJUSTABLE LOCATION				8.2	5.5	36.0	
ZONE3 ACCOMODATED	96						

	ANG LIMITS	3					
BOTH ENDS							
	ZONE3 ACCOMODATED	96					
	TOO FAR	3					
19 HYD BOOST CIR BK			LH UNLK FTIP	8.2	-2.4	36.0	
	ZONE3 ACCOMODATED	0					
	ANG LIMITS	100					
ADJUSTABLE LOCATION				8.2	-2.4	36.0	
	ZONE3 ACCOMODATED	0					
	ANG LIMITS	100					
BOTH ENDS							
	ZONE3 ACCOMODATED	0					
	TOO FAR	100					
20 FUEL VALVE HANDLE			LH UNLK CLEN	12.4	14.0	36.0	
	ZONE3 ACCOMODATED	34					
	ANG LIMITS	65					
ADJUSTABLE LOCATION				12.4	14.0	36.0	
	ZONE3 ACCOMODATED	34					
	ANG LIMITS	65					
BOTH ENDS							
	ZONE3 ACCOMODATED	34					
	TOO FAR	65					
21 EMER DOOR REL			LH UNLK CLEN	-9.0	18.3	29.5	
	ZONE3 ACCOMODATED	100					
ADJUSTABLE LOCATION				-9.0	18.3	29.5	
	ZONE3 ACCOMODATED	100					
BOTH ENDS							
	ZONE3 ACCOMODATED	100					
22 CAU TEST/RESET			LH UNLK EXTP	10.8	18.1	-2.5	
	ZONE3 ACCOMODATED	55					
	ANG LIMITS	3					
	TOO FAR	41	AVERAGE	-0.3	-0.2	0.6	0.7
			WORSE CASE	-0.6	-0.5	1.1	1.3
ADJUSTABLE LOCATION				10.8	18.1	-2.5	
	ZONE3 ACCOMODATED	55					
	ANG LIMITS	3					
	TOO FAR	41	AVERAGE	-0.3	-0.2	0.6	0.7
			WORSE CASE	-0.6	-0.5	1.1	1.3
BOTH ENDS							
	ZONE3 ACCOMODATED	55					
	TOO FAR	44					
23 FM RADIO			LH UNLK FTIP	6.8	17.6	-2.5	
	ZONE3 ACCOMODATED	34					
	TOO FAR	65	AVERAGE	-0.4	-0.4	0.9	1.1
			WORSE CASE	-0.8	-0.8	1.8	2.1

```
ADJUSTABLE LOCATION                                  6.8   17.6   -2.5
     ZONE3 ACCOMODATED      34
           TOO FAR          65   AVERAGE            -0.4   -0.4    0.9    1.1
                                 WORSE CASE         -0.8   -0.8    1.8    2.1

BOTH ENDS
     ZONE3 ACCOMODATED      34
           TOO FAR          65
-------------------------------------------------------------------------------
24 ADF RECEIVER                       LH  UNLK FTIP    6.8   22.1   -2.5
     ZONE3 ACCOMODATED       0
           TOO FAR          100   AVERAGE            -1.0   -1.2    2.0    2.5
                                 WORSE CASE         -1.5   -1.9    3.3    4.1

ADJUSTABLE LOCATION                                  6.8   22.1   -2.5
     ZONE3 ACCOMODATED       0
           TOO FAR          100   AVERAGE            -1.0   -1.2    2.0    2.5
                                 WORSE CASE         -1.5   -1.9    3.3    4.1

BOTH ENDS
     ZONE3 ACCOMODATED       0
           TOO FAR          100
-------------------------------------------------------------------------------


CAR(1-OPER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--
          5

END OF CAR MODEL
```

APPENDIX H

CREWSTATION ANALYSIS-OBSERVER

```
CREWSTATION ASSESSMENT OF REACH (CAR) MODEL

CAR(1-OPER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--
       3
  INDICATE WHICH CONTROLS ARE TO BE ANALYZED(0=ALL;N,M=RANGE)--
  1  24
  SAMPLE SIZE(0=ALL;N,M=RANGE)--
  1  50
  DISPLAY OPERATOR IDS FOR REACH FAILURE(0-NO,1-YES)--
  0
  RESTRICT SAMPLE BASED UPON MEAS PERCENTILES (0-NO,1-YES)---
  1
  ENTER LOWER AND UPPER PERCENTILE VALUES--
  5  95
  CLOTHING(1-NONE;2-SUMMER;3-WINTER)--
  2
  ANALYSIS OPTION(1-ALL OPERATORS,2-OPERATORS ON LOS ONLY)--
  1
  REACH ALGORITHM(1=PASS THROUGH CONTROL,2-TERMINATE AT CONTROL)--
  2
***OPERATOR NO:    1 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      2
***OPERATOR NO:    5 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      5
***OPERATOR NO:    6 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      7
***OPERATOR NO:    7 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      2
***OPERATOR NO:   11 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      8
***OPERATOR NO:   12 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   13 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      2
***OPERATOR NO:   14 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   15 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      4
***OPERATOR NO:   22 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   24 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   28 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   30 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     10
***OPERATOR NO:   34 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      5
***OPERATOR NO:   36 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      5
***OPERATOR NO:   37 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      7
***OPERATOR NO:   39 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     11
***OPERATOR NO:   40 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      2
***OPERATOR NO:   43 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   44 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   46 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      5


                  ------------------------------
                  CREWSTATION ASSESSMENT OF REACH
                  ------------------------------

SAMPLE:           ARMY AVIATORS                          FILE:
OPERATOR NOS:       1- 50
MEASUREMENT:      STATURE                                PERCENTILE:  5- 95
NO OPER ANALYZED:  29
CLOTHING:         SUMMER

CREWSTATION:      OH-58A COC KPIT-CBS                    FILE:        MEAS/ST
ANCHORAGE:        SEAT
```

DEP:	0.00	3.90	33.03	LOS ANGLE:	-13.0
SEAT BACK:	9.00			SEAT PAN:	8.0
TRACKS:	LEFT	RIGHT		HARNESS:	50.%
DOWN BACK:	0.00	0.00	0.00		

REACH ALGORITHM: TERMINATE AT CONTROL

VISION ACCOMMODATION

	LINE OF SIGHT ABOVE		ON		BELOW	
	%	DIST	%	DIST	%	DIST
FORWARD OF DEP	0.00	0.00	0.00	0.00	79.31	2.13
BEHIND DEP	0.00	0.00	0.00	0.00	20.69	0.32

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM DEP

VERTICAL	HORIZONTAL
-1.74	0.19

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM SEAT DB

VERTICAL	HORIZONTAL
0.00	0.00

PERCENTAGE OF CREWPEOPLE ACCOMMODATED

POSITION TO VISION POINT 0.00

	ALL CONTROLS ZONE1&3	ALL CONTROLS ZONE2&3	PRIMARY ONLY ZONE1&3	PRIMARY ONLY ZONE2&3
REACH CONTROLS	0.00	0.00	0.00	0.00
VISION POINT&REACH CONTROLS	0.00	0.00	0.00	0.00

CONTROL SUMMARY

NO	CONTROL NAME	%	HAND FOOT	HARN LOCK	GRIP	LOCATION/ REQUIRED MOVEMENT X	Y	Z
1	*CYCLIC		RH	UNLK	CLEN	0.0	19.5	11.6
	ZONE3 ACCOMODATED	100						
2	*COLLECTIVE		LH	UNLK	CLEN	-10.8	17.3	0.0
	ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION						-10.8	12.5	8.8
	ZONE3 ACCOMODATED	100						

BOTH ENDS

ZONE3 ACCOMODATED	100					
3*RT ANTITORQUE PED		RF		4.0	32.6	-5.3
ZONE3 ACCOMODATED	34					
ANG LIMITS	65					
ADJUSTABLE LOCATION			4.0	42.1	-7.8	
ZONE3 ACCOMODATED	0					
TOO FAR	100	AVERAGE		-1.4	-2.9	0.0	3.2
		WORSE CASE		-2.2	-4.6	-0.1	5.1
BOTH ENDS						
ZONE3 ACCOMODATED	0					
TOO FAR	100					
4*LFT ANTITORQUE PED		LF		-5.5	32.6	-6.3
ZONE3 ACCOMODATED	100					
ADJUSTABLE LOCATION			-5.5	42.1	-7.8	
ZONE3 ACCOMODATED	0					
TOO FAR	100	AVERAGE		1.1	-2.4	-0.1	2.7
		WORSE CASE		1.9	-4.1	-0.2	4.6
BOTH ENDS						
ZONE3 ACCOMODATED	0					
TOO FAR	100					
5 FUEL BOOST SW		RH UNLK EXTP		19.5	30.0	7.1
ZONE3 ACCOMODATED	100					
ADJUSTABLE LOCATION			19.5	30.0	7.1	
ZONE3 ACCOMODATED	100					
BOTH ENDS						
ZONE3 ACCOMODATED	100					
6 COPILOT ICS SELECT		LH UNLK FTIP		-2.8	30.0	6.6
ZONE3 ACCOMODATED	75					
TOO FAR	24	AVERAGE		0.0	-0.3	0.2	0.3
		WORSE CASE		-0.1	-0.5	0.4	0.7
ADJUSTABLE LOCATION			-2.8	30.0	6.6	
ZONE3 ACCOMODATED	75					
TOO FAR	24	AVERAGE		0.0	-0.3	0.2	0.3
		WORSE CASE		-0.1	-0.5	0.4	0.7
BOTH ENDS						
ZONE3 ACCOMODATED	75					
TOO FAR	24					
7 FORCE TRIM SW		RH UNLK EXTP		18.5	30.0	10.1
ZONE3 ACCOMODATED	100					
ADJUSTABLE LOCATION			18.5	30.0	10.1	
ZONE3 ACCOMODATED	100					
BOTH ENDS						
ZONE3 ACCOMODATED	100					
8 HYD BOOST SW		RH UNLK FTIP		19.5	30.0	10.1

	ZONE3 ACCOMODATED	100					
ADJUSTABLE LOCATION				29.5	30.0	10.1	
	ZONE3 ACCOMODATED	100					
BOTH ENDS							
	ZONE3 ACCOMODATED	100					
9 ALT SET KNOB			RH	UNLK FTIP	17.2	30.0	15.1
	ZONE3 ACCOMODATED	100					
ADJUSTABLE LOCATION				17.2	30.0	15.1	
	ZONE3 ACCOMODATED	100					
BOTH ENDS							
	ZONE3 ACCOMODATED	100					
10 UHF RADIO			RH	UNLK FTIP	7.0	30.0	4.6
	ZONE3 ACCOMODATED	68					
	TOO FAR	31	AVERAGE		0.0	-0.4	0.3	0.5
			WORSE CASE		0.0	-0.8	0.6	1.0
ADJUSTABLE LOCATION				7.0	30.0	4.6	
	ZONE3 ACCOMODATED	68					
	TOO FAR	31	AVERAGE		0.0	-0.4	0.3	0.5
			WORSE CASE		0.0	-0.8	0.6	1.0
BOTH ENDS							
	ZONE3 ACCOMODATED	68					
	TOO FAR	31					
11 VHF RADIO			RH	UNLK FTIP	0.5	30.0	11.1
	ZONE3 ACCOMODATED	100					
ADJUSTABLE LOCATION				0.5	30.0	11.1	
	ZONE3 ACCOMODATED	100					
BOTH ENDS							
	ZONE3 ACCOMODATED	100					
12 TRANSPONDER			RH	UNLK FTIP	0.5	30.0	16.1
	ZONE3 ACCOMODATED	96					
	TOO FAR	3	AVERAGE		0.0	0.0	0.0	0.0
			WORSE CASE		0.0	0.0	0.0	0.0
ADJUSTABLE LOCATION				0.5	30.0	16.1	
	ZONE3 ACCOMODATED	96					
	TOO FAR	3	AVERAGE		0.0	0.0	0.0	0.0
			WORSE CASE		0.0	0.0	0.0	0.0
BOTH ENDS							
	ZONE3 ACCOMODATED	96					
	TOO FAR	3					
13 CLOCK			RH	UNLK EXTF	12.2	30.0	22.1
	ZONE3 ACCOMODATED	100					
ADJUSTABLE LOCATION				12.2	30.0	22.1	
	ZONE3 ACCOMODATED	100					

BOTH ENDS							
ZONE3 ACCOMODATED	100						
14 INVERTER SW		RH	UNLK	EXTF	10.1	11.5	36.0
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION					10.1	11.5	36.0
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
15 BAT/GEN SWS		RH	UNLK	EXTF	8.2	11.5	36.0
ZONE3 ACCOMODATED	96						
ANG LIMITS	3						
ADJUSTABLE LOCATION					8.2	11.5	36.0
ZONE3 ACCOMODATED	96						
ANG LIMITS	3						
BOTH ENDS							
ZONE3 ACCOMODATED	96						
TOO FAR	3						
16 ROW 2 SW, OVRHD		RH	UNLK	EXTF	8.2	9.1	36.0
ZONE3 ACCOMODATED	55						
ANG LIMITS	44						
ADJUSTABLE LOCATION					8.2	9.1	36.0
ZONE3 ACCOMODATED	55						
ANG LIMITS	44						
BOTH ENDS							
ZONE3 ACCOMODATED	55						
TOO FAR	44						
17 ROW 3 SW,OVRHD		RH	UNLK	EXTF	8.2	7.8	36.0
ZONE3 ACCOMODATED	20						
ANG LIMITS	79						
ADJUSTABLE LOCATION					8.2	9.1	36.0
ZONE3 ACCOMODATED	55						
ANG LIMITS	44						
BOTH ENDS							
ZONE3 ACCOMODATED	20						
TOO FAR	79						
18 LGT CONT KNOBS		RH	UNLK	FTIP	8.2	5.5	36.0
ZONE3 ACCOMODATED	58						
ANG LIMITS	41						
ADJUSTABLE LOCATION					8.2	5.5	36.0
ZONE3 ACCOMODATED	58						
ANG LIMITS	41						
BOTH ENDS							
ZONE3 ACCOMODATED	58						
TOO FAR	41						

19 HYD BOOST CIR BK			RH	UNLK FTIP	8.2	-2.4	36.0
ZONE3 ACCOMODATED	34						
ANG LIMITS	65						
ADJUSTABLE LOCATION					8.2	-2.4	36.0
ZONE3 ACCOMODATED	34						
ANG LIMITS	65						
BOTH ENDS							
ZONE3 ACCOMODATED	34						
TOO FAR	65						
20 FUEL VALVE HANDLE			RH	UNLK CLEN	12.4	14.0	36.0
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION					12.4	14.0	36.0
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
21 ENER DOOR REL			LH	UNLK CLEN	-9.0	18.3	29.5
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION					-9.0	18.3	29.5
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
22 CAU TEST/RESET			RH	UNLK EXTF	10.8	18.1	-2.5
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION					10.8	18.1	-2.5
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
23 FM RADIO			RH	UNLK FTIP	6.8	17.6	-2.5
ZONE3 ACCOMODATED	100						
ADJUSTABLE LOCATION					6.8	17.6	-2.5
ZONE3 ACCOMODATED	100						
BOTH ENDS							
ZONE3 ACCOMODATED	100						
24 ADF RECEIVER			RH	UNLK FTIP	6.8	22.1	-2.5
ZONE3 ACCOMODATED	89						
TOO FAR	10	AVERAGE			0.0	-0.2	0.4 0.4
		WORSE CASE			0.0	-0.3	0.5 0.6
ADJUSTABLE LOCATION					6.8	22.1	-2.5
ZONE3 ACCOMODATED	89						
TOO FAR	10	AVERAGE			0.0	-0.2	0.4 0.4
		WORSE CASE			0.0	-0.3	0.5 0.6
BOTH ENDS							
ZONE3 ACCOMODATED	89						

TOO FAR 10

CAR (1-OPER SAMPLE, 2-CREWSTATION, 3-ACCOM ANALYSIS, 4-REACH ENV, 5-END) --
5

END OF CAR MODEL

APPENDIX I

CREWSTATION ANALYSIS RESULTS OF CONTROL MOVEMENTS

```
CREWSTATION ASSESSMENT OF REACH (CAR) MODEL

CAR(1-OPER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--
          3
 INDICATE WHICH CONTROLS ARE TO BE ANALYZED(0=ALL;N,M=RANGE)--
10  10
 SAMPLE SIZE(0=ALL;N,M=RANGE)--
 1  50
 DISPLAY OPERATOR IDS FOR REACH FAILURE(0-NO,1-YES)--
 0
 RESTRICT SAMPLE BASED UPON MEAS PERCENTILES (0-NO,1-YES)---
 1
 ENTER LOWER AND UPPER PERCENTILE VALUES--
 5  95
 CLOTHING(1-NONE;2-SUMMER;3-WINTER)--
 2
 ANALYSIS OPTION(1-ALL OPERATORS,2-OPERATORS ON LOS ONLY)--
 1
 REACH ALGORITHM(1=PASS THROUGH CONTROL,2-TERMINATE AT CONTROL)--
 2
***OPERATOR NO:    1 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      2
***OPERATOR NO:    5 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      5
***OPERATOR NO:    6 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      7
***OPERATOR NO:    7 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      2
***OPERATOR NO:   11 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      8
***OPERATOR NO:   12 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   13 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      2
***OPERATOR NO:   14 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   15 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      4
***OPERATOR NO:   22 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   24 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   28 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   30 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     10
***OPERATOR NO:   34 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      5
***OPERATOR NO:   36 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      5
***OPERATOR NO:   37 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      7
***OPERATOR NO:   39 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     11
***OPERATOR NO:   40 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      2
***OPERATOR NO:   43 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   44 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      1
***OPERATOR NO:   46 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:      5


                  ------------------------------
                  CREWSTATION ASSESSMENT OF REACH
                  ------------------------------

SAMPLE:             ARMY AVIATORS                          FILE:
OPERATOR NOS:         1- 50
MEASUREMENT:        STATURE                                PERCENTILE:  5- 95
NO OPER ANALYZED:   29
CLOTHING:           SUMMER

CREWSTATION:        OH-58A COC KPIT-PILOT                  FILE:        MEAS/ST
ANCHORAGE:          SEAT
```

DEP:	0.00	3.90	33.03	LOS ANGLE:	-13.0
SEAT BACK:	9.00			SEAT PAN:	8.0
TRACKS:	LEFT	RIGHT		HARNESS:	50.%
DOWN BACK:	0.00	0.00	0.00		

REACH ALGORITHM: TERMINATE AT CONTROL

VISION ACCOMMODATION

	LINE OF SIGHT ABOVE		ON		BELOW	
	%	DIST	%	DIST	%	DIST
FORWARD OF DEP	0.00	0.00	0.00	0.00	79.31	2.13
BEHIND DEP	0.00	0.00	0.00	0.00	20.69	0.32

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM DEP

VERTICAL	HORIZONTAL
-1.74	0.19

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM SEAT DB

VERTICAL	HORIZONTAL
0.00	0.00

PERCENTAGE OF CREWPEOPLE ACCOMMODATED

POSITION TO VISION POINT 0.00

	ALL CONTROLS ZONE1&3	ALL CONTROLS ZONE2&3	PRIMARY ONLY ZONE1&3	PRIMARY ONLY ZONE2&3
REACH CONTROLS	93.10	93.10	0.00	0.00
VISION POINTREACH CONTROLS	0.00	0.00	0.00	0.00

CONTROL SUMMARY

NO	CONTROL NAME	%	HAND FOOT	HARN LOCK	GRIP	LOCATION/ REQUIRED MOVEMENT X	Y	Z	
10	UHF RADIO		LH	UNLK	PTIP	-13.3	30.0	5.6	
	ZONE3 ACCOMODATED	93							
	TOO FAR	6	AVERAGE			0.0	-0.1	0.1	0.2
			WORSE CASE			0.0	-0.2	0.1	0.2
ADJUSTABLE LOCATION						-12.3	30.0	5.6	
	ZONE3 ACCOMODATED	93							
	TOO FAR	6	AVERAGE			0.0	-0.1	0.1	0.1
			WORSE CASE			0.0	-0.1	0.1	0.1

```
BOTH ENDS
     ZONE3 ACCOMODATED      93
           TOO FAR           6
-------------------------------------------------------------------------

CAR (1-OPER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--
          5

END OF CAR MODEL
```

```
CREWSTATION ASSESSMENT OF REACH (CAR) MODEL

CAR(1-OPER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--
        3
 INDICATE WHICH CONTROLS ARE TO BE ANALYZED(0=ALL;N,M=RANGE)--
10  10
 SAMPLE SIZE(0=ALL;N,M=RANGE)--
 1  50
 DISPLAY OPERATOR IDS FOR REACH FAILURE(0-NO,1-YES)--
 0
 RESTRICT SAMPLE BASED UPON MEAS PERCENTILES (0-NO,1-YES)---
 1
 ENTER LOWER AND UPPER PERCENTILE VALUES--
 5  95
 CLOTHING(1-NONE;2-SUMMER;3-WINTER)--
 2
 ANALYSIS OPTION(1-ALL OPERATORS,2-OPERATORS ON LOS ONLY)--
 1
 REACH ALGORITHM(1=PASS THROUGH CONTROL,2-TERMINATE AT CONTROL)--
 2
***OPERATOR NO:   1 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     2
***OPERATOR NO:   5 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     5
***OPERATOR NO:   6 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     7
***OPERATOR NO:   7 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     2
***OPERATOR NO:  11 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     8
***OPERATOR NO:  12 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  13 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     2
***OPERATOR NO:  14 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  15 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     4
***OPERATOR NO:  22 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  24 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  28 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  30 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:    10
***OPERATOR NO:  34 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     5
***OPERATOR NO:  36 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     5
***OPERATOR NO:  37 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     7
***OPERATOR NO:  39 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:    11
***OPERATOR NO:  40 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     2
***OPERATOR NO:  43 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  44 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  46 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     5


                  ------------------------------
                  CREWSTATION ASSESSMENT OF REACH
                  ------------------------------

SAMPLE:             ARMY AVIA TORS                          FILE:
OPERATOR NOS:         1- 50
MEASUREMENT:        STATURE                                 PERCENTILE:  5- 95
NO OPER ANALYZED:   29
CLOTHING:           SUMMER

CREWSTATION:        OH-58A COC KPIT-COPILOT                 FILE:        MEAS/ST
ANCHORAGE:          SEAT
```

DEP:	0.00	3.90	33.03	LOS ANGLE:	-13.0
SEAT BACK:	9.00			SEAT PAN:	8.0
TRACKS:	LEFT	RIGHT		HARNESS:	50.%
DOWN BACK:	0.00	0.00	0.00		

REACH ALGORITHM: TERMINATE AT CONTROL

VISION ACCOMMODATION

	LINE OF SIGHT ABOVE		ON		BELOW	
	%	DIST	%	DIST	%	DIST
FORWARD OF DEP	0.00	0.00	0.00	0.00	79.31	2.13
BEHIND DEP	0.00	0.00	0.00	0.00	20.69	0.32

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM DEP

VERTICAL	HORIZONTAL
-1.74	0.19

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM SEAT DB

VERTICAL	HORIZONTAL
0.00	0.00

PERCENTAGE OF CREWPEOPLE ACCOMMODATED

POSITION TO VISION POINT 0.00

	ALL CONTROLS ZONE1&3	ALL CONTROLS ZONE2&3	PRIMARY ONLY ZONE1&3	PRIMARY ONLY ZONE2&3
REACH CONTROLS	0.00	0.00	0.00	0.00
VISION POINT&REACH CONTROLS	0.00	0.00	0.00	0.00

CONTROL SUMMARY

NO	CONTROL NAME	%	HAND FOOT	HARN LOCK	GRIP	LOCATION/ REQUIRED MOVEMENT X	Y	Z	
10	UHF RADIO		LH	UNLK	FTIP	7.0	30.0	5.6	
	ZONE3 ACCOMODATED	0							
	TOO FAR	100	AVERAGE			-0.9	-1.7	1.2	2.3
			WORSE CASE			-1.5	-2.6	2.0	3.6
ADJUSTABLE LOCATION					8.0	30.0	5.6		
	ZONE3 ACCOMODATED	0							
	TOO FAR	100	AVERAGE			-1.1	-1.9	1.4	2.6
			WORSE CASE			-1.7	-2.8	2.2	4.0

```
BOTH ENDS
     ZONE3 ACCOMODATED       0
           TOO FAR         100
-------------------------------------------------------------------------------



CAR(1-OPER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--
          5

END OF CAR MODEL
```

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CREWSTATION ASSESSMENT OF REACH (CAR) MODEL

CAR(1-OPER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--
      3
 INDICATE WHICH CONTROLS ARE TO BE ANALYZED(0=ALL;N,M=RANGE)--
10  10
 SAMPLE SIZE(0=ALL;N,M=RANGE)--
 1  50
 DISPLAY OPERATOR IDS FOR REACH FAILURE(0-NO,1-YES)--
 0
 RESTRICT SAMPLE BASED UPON MEAS PERCENTILES (0-NO,1-YES)---
 1
 ENTER LOWER AND UPPER PERCENTILE VALUES--
 5  95
 CLOTHING(1-NONE;2-SUMMER;3-WINTER)--
 2
 ANALYSIS OPTION(1-ALL OPERATORS,2-OPERATORS ON LOS ONLY)--
 1
 REACH ALGORITHM(1=PASS THROUGH CONTROL,2-TERMINATE AT CONTROL)--
 2
***OPERATOR NO:   1 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     2
***OPERATOR NO:   5 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     5
***OPERATOR NO:   6 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     7
***OPERATOR NO:   7 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     2
***OPERATOR NO:  11 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     8
***OPERATOR NO:  12 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  13 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     2
***OPERATOR NO:  14 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  15 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     4
***OPERATOR NO:  22 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  24 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  28 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  30 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:    10
***OPERATOR NO:  34 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     5
***OPERATOR NO:  36 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     5
***OPERATOR NO:  37 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     7
***OPERATOR NO:  39 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:    11
***OPERATOR NO:  40 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     2
***OPERATOR NO:  43 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  44 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     1
***OPERATOR NO:  46 FALLS OUTSIDE MEAS RANGE *** FOR MEASUREMENT:     5


                  ----------------------------
                  CREWSTATION ASSESSMENT OF REACH
                  ----------------------------

SAMPLE:             ARMY AVIATORS                          FILE:
OPERATOR NOS:         1- 50
MEASUREMENT:        STATURE                                PERCENTILE:  5- 95
NO OPER ANALYZED:   29
CLOTHING:           SUMMER

CREWSTATION:        OH-58A COCKPIT-OBS                     FILE:        MEAS/ST
ANCHORAGE:          SEAT
```

DEP:	0.00	3.90	33.03	LOS ANGLE:	-13.0
SEAT BACK:	9.00			SEAT PAN:	8.0
TRACKS:	LEFT	RIGHT		HARNESS:	50.%
DOWN BACK:	0.00	0.00	0.00		

REACH ALGORITHM: TERMINATE AT CONTROL

VISION ACCOMMODATION

	LINE OF SIGHT					
	ABOVE		ON		BELOW	
	%	DIST	%	DIST	%	DIST
FORWARD OF DEP	0.00	0.00	0.00	0.00	79.31	2.13
BEHIND DEP	0.00	0.00	0.00	0.00	20.69	0.32

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM DEP

VERTICAL	HORIZONTAL
-1.74	0.19

AVERAGE VERTICAL AND HORIZONTAL DISPLACEMENT FROM SEAT DB

VERTICAL	HORIZONTAL
0.00	0.00

PERCENTAGE OF CREWPEOPLE ACCOMMODATED

POSITION TO VISION POINT 0.00

	ALL CONTROLS		PRIMARY ONLY	
	ZONE1&3	ZONE2&3	ZONE1&3	ZONE2&3
REACH CONTROLS	89.66	89.66	0.00	0.00
VISION POINT&REACH CONTROLS	0.00	0.00	0.00	0.00

CONTROL SUMMARY

NO	CONTROL NAME	%	HAND	HARN FOOT	LOCK	GRIP	LOCATION/ REQUIRED MOVEMENT X	Y	Z	
10	UHF RADIO		RH		UNLK	FTIP	7.0	30.0	5.6	
	ZONE3 ACCOMODATED	89								
	TOO FAR	10	AVERAGE				0.0	-0.2	0.2	0.3
			WORSE CASE				0.0	-0.3	0.2	0.4
ADJUSTABLE LOCATION							8.0	30.0	5.6	
	ZONE3 ACCOMODATED	89								
	TOO FAR	10	AVERAGE				0.0	-0.1	0.1	0.2
			WORSE CASE				0.0	-0.2	0.2	0.3

```
BOTH ENDS
     ZONE3 ACCOMODATED      89
           TOO FAR          10
-------------------------------------------------------------------------

CAR(1-OPER SAMPLE,2-CREWSTATION,3-ACCOM ANALYSIS,4-REACH ENV,5-END)--
          5

END OF CAR MODEL
```